SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LIV.—No. 7. [NEW SERIES.] NEW YORK, FEBRUARY 13, 1886. [$3.20 per Annum. [POSTAGE PREPAID.]

THE MARVIN SAFE.

The building of which we herewith present views of the two fronts (Fig. 3) was recently erected by the Marvin Safe Company, of this city, to replace the one destroyed by fire a few months ago. The building is a handsome and substantial structure of brick and iron, specially designed to meet the requirements of the work carried on in it, and is of unusual strength, in order to safely bear the great weight brought upon each floor. A safe, during the various stages of its manufacture, passes from the basement, where the crude material is delivered, up through the several departments to the top story, where it receives from the hand of the artist those final touches which render it ornamental as well as useful.

In the basement are the boilers and engines and the forging room. It becomes evident, when we consider the severe trials a safe is sometimes subjected to, that the frame should be of the strongest possible construction, and, to insure this, should be formed of one continuous piece of metal. A built-up frame not only presents more possible passages for the escape of the filling and the entrance of heat, but possesses less strength, and is therefore less able to successfully withstand the shock of falling, to which nine out of every ten safes are subjected to in a fire. If it were known that a safe would be called upon only to resist the effect of intense heat, and would not be dropped while hot into the cellar of the burning building, the problem of safe manufacture would be relieved of one of its most troublesome factors. Recognizing this fact, the Marvin safe is made with a continuous four-sided angle iron frame, thereby securing the strongest form of construction. The side and top panels fit within and overlap these angles, while the back frame is slotted to receive up and within it the back plate, which, after being slid to its place, is secured by a separate bottom piece, closing the gap at the bottom of the frame, and is in turn fastened to the frame by rivets. The back plate is further secured by fastenings passing through the outer angle iron frame, through the back plate, and entering an inside system of angles.

The front frame of the safe is stepped to receive the door, which is correspondingly stepped. A new and admirable feature is here introduced. A tongue and groove extends along or round the side, top, and bottom of the door opening, but not down the side against which the hinged side of the door rests. The door itself is made with a corresponding tongue and groove on like sides, so that the tongues of the frame

(*Continued on page* 100.)

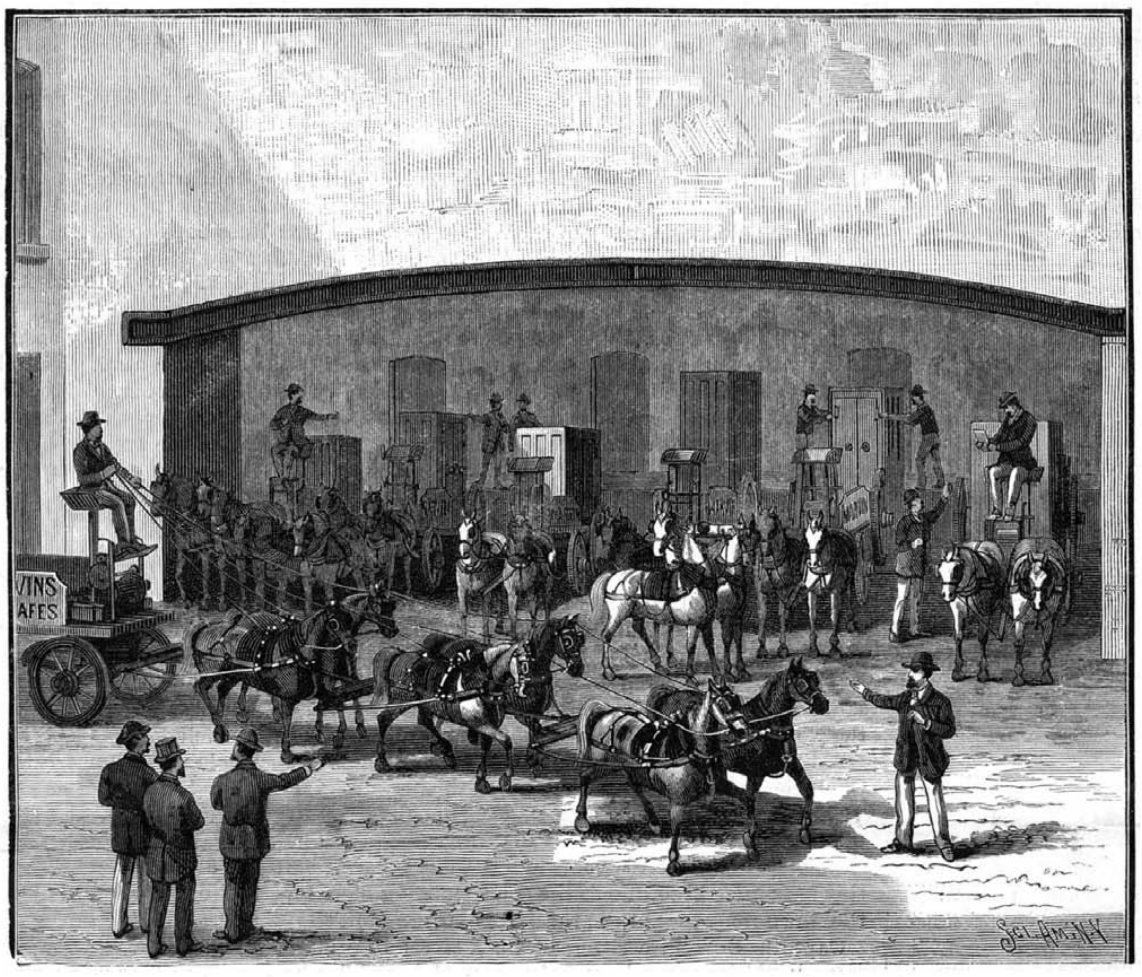


Fig. 1.—SHIPPING YARD AT THE FACTORY OF THE MARVIN SAFE COMPANY.

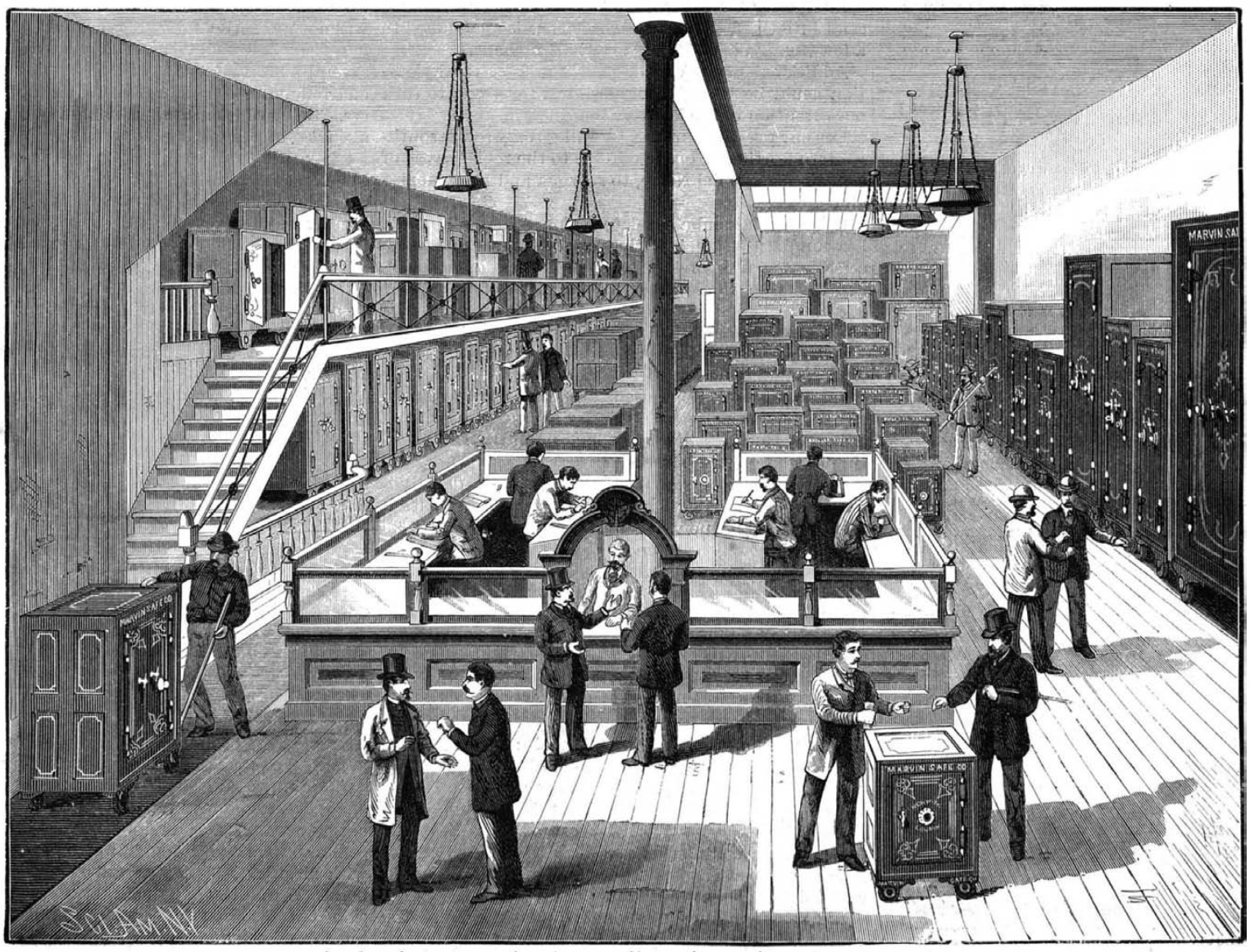
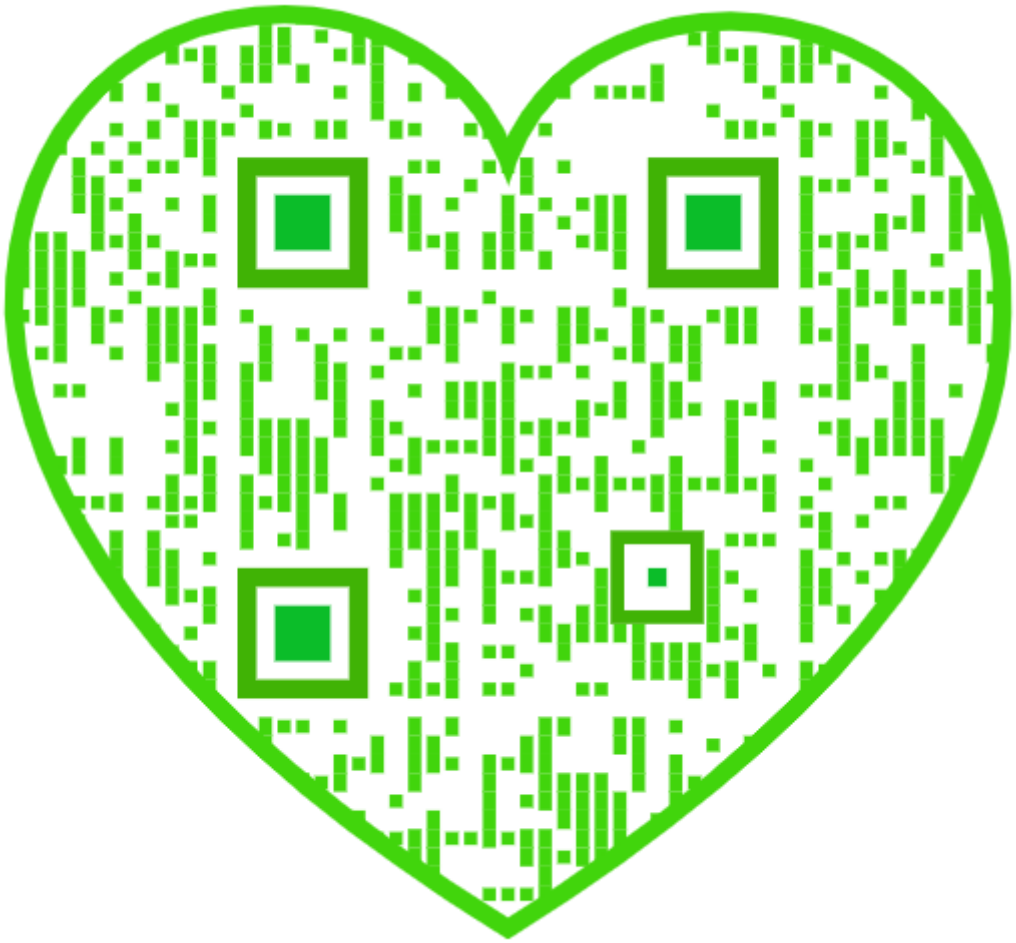


Fig. 2.—MARVIN SAFE COMPANY.—INTERIOR OF THE BROADWAY STORE.

© 1886 SCIENTIFIC AMERICAN, INC



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal or express money order. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, FEBRUARY 13, 1886.

Contents.

(Illustrated articles are marked with an asterisk.)

Bacon, Francis W..... 98
Beer brewing in New York and Brooklyn..... 99
Bellows, improved*..... 98
Bicycles, treadle for, improved*. 105
Birds and gold of California.. 101
Books and publications, new..... 106
Brick, new kind of..... 97
Brickwork*..... 99
Bullfrog, the*..... 103
Business and personal..... 106
Carbonic acid as a fire extinguisher at sea..... 96
Cartridge, electrolytic, for blasting..... 105
Cheese, digestibility of..... 100
Clothes drier, Bogle's*..... 98
Corn, bushel of, alcoholic value of..... 102
Cotton batting for water pipes... 99
Crank, the, defended..... 100
Dynamite shells, firing, proposed method of..... 101
Electro magnets, improvements in*..... 102
Fire escape, improved*..... 98
Gas well, another remarkable..... 98
Glass balls, silvered, for signaling 102
Guns worked by steam, gas, and compressed air..... 105
Hose, steam*..... 104
Inventions, agricultural..... 106
Inventions, engineering..... 106
Inventions, index of..... 107
Inventions, miscellaneous..... 106
Inventors, an opportunity for.... 101
Ironing board*..... 98
Loom, principle of the*..... 99
Marvin Safe Co.—Factory and store*.....95, 100
Mind cure..... 101
Minutes, the, worth saving..... 105
Notes and queries.....106, 107
Organs and pianofortes, old*..... 103
Paper, waterproofing..... 105
Photographic notes..... 97
Photography of a tiger and its prey..... 100
Pipes, steam, danger from.... 101
Rabbit plague in Australia..... 97
Rainfall, our average, is it diminishing?..... 96
Reservoir construction, improved 102
Selenium, new source of..... 101
Shuttles and heddle made of cardboard*..... 99
Telephone caveat of Antonio Meucci..... 104
Trustee, new, for Stevens Institute, appointment of a..... 97
Water supply for Chicago, new, proposed..... 98

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 528

For the Week Ending February 13, 1886.

Price 10 cents. For sale by all newsdealers.

PAGE

I. CHEMISTRY AND METALLURGY.—Sulphite of Soda.—Estimation.—Standard solutions.—Actual assay.—Example..... 8438
Properties of Zinc..... 8438
Electrolytic Separationof Zinc and Cadmium.—By S. ELIASBERG. 8434

II. ENGINEERING AND MECHANICS.—Inclined Shaft Rotary Engine.—With descriptions of different machines and 6 figures..... 8423
A Steam Pump for Liquid Lead..... 8424
Coal Cutting Machinery and the Application of Rope Power Thereto.—By Messrs. T. and R. W. BOWER..... 8424
Handling a Locomotive.—Differences in engines.—Preparation required for an engineer.—Repairing while on theroad..... 8425
Shaft Sinking through Quicksand..... 8425
Indicating Fire Damp in Coal Mines.—Apparatus invented by HENRY GUY CARLETON.—2 engravings..... 8426
Demange and Satre's Excavator.—With engraving..... 8429
Improved Power Motor.—With description and 3 figures..... 8430

III. TECHNOLOGY.—Ax Making.—Material used.—Heating, grinding, tempering, etc.—4 engravings..... 8427
Sugar.—By G. BUCHANAN.—Cane sugar industry.—Beet sugar in Germany.—Improved machinery required.—Cultivation of cane. Inferiority of beet sugar..... 8428
Hints on the Preservation of Type.—By J. L. LEE.—Read before the Michigan and W. Michigan Press Association..... 8428
Apparatus for Bakeries.—2 engravings..... 8429
A New Mounting Medium of High Refractive Index..... 8429
New Method of Protecting Iron Pipes from Rust.—By H. B. SCOTT..... 8430
Cutting and Resurfacing our Wood Pavement..... 8431

IV. ARCHITECTURE.—Holford Hall, near Knutsford.—Half timbered old manor house.—With engraving..... 8431

V. PHYSICS, ELECTRICITY, ETC.—Underground Temperatures.—Report of the Committee for Investigating the Increase of Underground Temperatures Downward.—By Prof. EVERETT..... 8432
The Blackpool Electric Tramways.—With description and full page of engravings..... 8432
Domestic Electric Lighting.—With engraving..... 8434
Curious Telephonic Experiments..... 8434
An Electric Supper..... 8435

VI. MINERALOGY, ETC.—Sources of Saltpeter.—By C. G. WARNFORD LOCK.—Conditions necessary for the formation of saltpeter.—Chief localities of production.—Extraction process..... 8435
Quartz and its Varieties.—By W. S. BEEKMAN..... 8437

VII. HYGIENE, ETC.—The Disinfection of Cattle Cars by Superheated Steam.—Experiments of Dr. Redard on French railways.... 8431
Fireproof Individuals.—Molten metals can be handled.—Persons proof against red-hot iron and flames.—2 engravings..... 8436

VIII. MISCELLANEOUS.—Economic Position of Australia.—Public debt.—Resources of the country.—The future rival of Australia.... 8436
The Froebel Method.—Toys used.—Numerous figures..... 8437
A Nineveh Wheel.—With engraving..... 8438

IS OUR AVERAGE RAINFALL DIMINISHING?

This may not concern us individually, for any changes would be very gradual, but no question can be of more vital interest than the *average* permanency of our water supply. If there be evidences that atmospheric precipitation is steadily descreasing throughout the historical world, we cannot fail to recognize their importance.

We shall, for the present at least, set aside geological proofs and confine ourselves entirely to recorded history, taking as our basis the oldest consecutive record, the Hebrew books.

The earliest traces of human history carry us to Asia, in its central and southwestern parts, and the most remote national movement of which we have any clear and continuous account is the migration of the Israelites from Egypt. After many years of devious wanderings, the Jewish tribes made their appearance in the plains of Moab, on the east side of the Dead Sea, not far from B.C. 1450, that is to say, somewhat over 3,300 years ago. An expedition was sent up by Moses, and made conquest of all the rich agricultural region to the north. The land was then swarming with inhabitants who were wealthy from commerce and from the cultivation of the soil. Their walled towns were numerous and strong. We need no evidence from the Bible to show us this, for there the towns stand now, perhaps 4,000 years old, with many of their houses as perfect as in the days of Og, King of Bashan. There they stand, "waste, without inhabitant."

There must be some reason for this, independent of social considerations. Men live there now, it is true, only by the might of the strong hand, but they did so 3,000 years ago; it is not the lack of protection by established law that has caused the desolation. The simple fact is that the land cannot furnish food for so dense a population. Its characteristic richness and fertility have passed away, and for this there can be but one cause, and that is the diminution of the annual rainfall.

It is well known that in the days of Chaldean glory the most fruitful land of antiquity was Mesopotamia. What is it now? "The land of great canals is desolate and barren, without settlement, a dried-up wilderness, . . . covered with the plants peculiar to a saline soil, and all this where once was the 'garden of the world.'" These are the words of an eye witness.

A little further, and we reach Persia. The India Geological Survey says of it: "From the account given by ancient writers, it appears highly probable that the population was much greater and the cultivated land far more extensive 2,000 years ago than at present, and this may have been due to the country being more fertile, in consequence of the rainfall being greater."

Captain Burton, writing of his travels in Midian, says: "This once wealthy and commercial land has become a desolation among the nations; the area of some 3,000 square miles, which, thirty-one centuries ago, could send into the field 135,000 swordsmen, is abandoned to a few hundreds—half peasants, half nomads."

Additional proofs of this slowly progressive desiccation could be brought forward, but we prefer to turn our attention to the Western continent.

For our present purpose, we will go only to the southwestern portion of our territory, to the region west of the Rio Grande del Norte, to Arizona and New Mexico alone.

It is a fearful and a desolate region. Here and there is a running stream, but they are few, and often inaccessible, for the land is made up of *mesas* and *barrancas*. One rides across a bare plain of sun-baked earth, when suddenly he is brought to an abrupt pause by a chasm, with nearly vertical sides, perhaps 1,000 feet deep. In its flat bottom one sees, perhaps, a small stream, perhaps not, for in most of these *barrancas* there is no water whatever, except for a few weeks of the winter. The *mesa* is as dry as the heart of the Sahara. But presently one comes upon the ruins of a single house, or possibly a number of houses—a large village. And so one goes on, and finds abundant evidence of quite a dense population, long since passed away. Many of the villages were on the *mesas*, others were in the *barrancas*, and, what is most astonishing, great numbers of them were not down on the bottom land, but high up on the nearly vertical cliffs, half way and more from their base to their summit. Some of these cliff dwellings are built of quarried stone, some of them are actually excavated from the solid rock, like those of Petra in Edom.

Mr. W. H. Holmes says, in respect to their age: "So great has been the erosion, that many of the caves have been almost obliterated." And again: "At the base of the cliff there is an almost total absence of debris, so that the period that has elapsed since these houses were deserted must equal the time taken to undermine the solid rock plus the time required to reduce this mass to dust; considering also that the erosive agents here are unusually weak, the resulting period would certainly not be inconsiderable."

We might adduce abundant quotations from the various surveys, notably the later ones of Hayden, all showing this one thing, that an abundant population once occupied the wide land which is now given up to barrenness and desolation. The region was then evidently "well watered, like the garden of the Lord," and this it certainly could not have been without a rainfall greatly in excess of that which now prevails.

One collateral fact is worthy of note, as a possible guide to the duration of time involved. One characteristic feature of the barren wastes stretching from Nevada southward is the nut pines, called commonly pinon. They are scattered here and there, and the nuts afford much food to the Indians. The trees are never large, but every one of them has the look of being very old. They are ragged, and battered, and torn by the storms of ages. But the point concerning them of interest to us now is this: there are no young trees among them. The nuts fall and never germinate, for lack of moisture. Where the pinons occur in mountain canons, supplied with water, the nuts take root as usual, but out on the desert plains the old ones are alone, and most surely when they are gone, there will be none in their place.

The inference, then, is plain that the nuts from which these present aged trees took their origin dropped on no such dry and barren earth as lies there now. It is no more certain that the cave dwellers of New Mexico and the men of the *mesas* must have had abundant water than that these pine nuts had it, and yet there stand the trees whose period of growth goes back to better days.

CARBONIC ACID AS A FIRE EXTINGUISHER AT SEA.

The steamer Crystal, of the Arrow Line, from Dundee, Scotland, recently came into New York Harbor with a fire in her hold, which had been raging for ten days. The vessel is divided into four water-tight compartments, separated by iron bulkheads. The one in which the fire was in progress is forty feet long, and extends from the upper deck to the keelson. Under the most favorable circumstances, a fire at sea is a terrible experience; the captain, however, maintained an admirable presence of mind, and at once ordered all the openings to be closed up and the hatches battened down. The cargo in that part of the vessel consisted of bales of jute, carpets, paper stock, and burlap, the smoke from which permeated the entire ship, and kept the crew outside for the greater part of the time. The decks are of iron, covered with wood, and great anxiety was felt lest the heat should fire the planking, and the whole vessel burst into flames.

Another source of grave anxiety was the possibility of the fore and aft bulkheads giving way, and permitting the fire a full sweep from bow to stern. When the fire was first discovered, the vessel was 700 miles east of Newfoundland. It was, however, with a full understanding of the danger that the captain decided to make straight for New York in preference to Halifax or other near ports, since it was only here that he could hope to secure such assistance as would enable him to save the vessel. The harbor was made at night, and it was not until the following morning that the patrol and fire boats could be summoned. After a fight of several hours, the fire was finally extinguished and the charred and water stained cargo discharged into lighters. Being of iron, the vessel itself suffered little damage from its temporary conversion into a furnace.

Though happily both crew and vessel were rescued, ten days of continuous apprehension made an experience almost as terrible as actual shipwreck. Such an occurrence forcibly brings up the question of suitable fire extinguishers for use at sea, for in this age of chemical and mechanical progress, it seems nothing less than gross carelessness that a large number of lives and an amount of valuable property should be placed at the mercy of preventable accidents. The laws of combustion are now well understood. Fire is no longer the mysterious element of the ancients. It is to us simply one of many chemical reactions which we represent by a series of formulæ with the same facility that we describe the rusting of iron or the action of respiration. All three operations belong, indeed, to the same class of reactions. It is the combination of their elements with oxygen. In the case of fire, the combination of the carbon and hydrogen with oxygen is attended with the production of heat, and the particles of the combining body, by means of this heat, are rendered luminous, giving us the accompanying phenomenon of flame.

Opposition to this reaction means simply cutting off the supply of oxygen. Ordinarily, water is used for this purpose. It is opposed to fire only because it shuts off the atmosphere, the source of supply of the free oxygen. Water itself contains a large amount of oxygen—88·88 per cent—but it is not available for supporting combustion, since the combining power of the oxygen is already exhausted; water is itself the product of the combustion of hydrogen. For the same reason, steam is also used for putting out fires. It becomes so soon condensed, however, and so soon diluted with air, that it is only effective when applied near at hand. A number of other substances might be mentioned which would be similarly fatal to combustion, but few of them are practicable until we come to carbonic acid gas.

This was proposed years ago for use as a fire extin-

© 1886 SCIENTIFIC AMERICAN, INC

guisher, but though it possesses many of the best qualities for such a purpose, it has never come into general use. It is readily procured, and cheap. It is heavier than air, and can therefore be poured over a fire very much as one would pour water. It is not only incapable of supporting combustion, but is itself perfectly incombustible, being the product of the complete oxidation of carbon. Even when diluted with three volumes of air it will still extinguish fire. These qualities would seem to recommend it highly for a more extended trial than it has yet had. It shares one of the disadvantages attending the use of steam or any other gas. It soon becomes mixed with the air and dispersed, unless applied very near at hand, or from above, under such circumstances that it can be poured into the scene of the fire without having too many vent holes below for its escape. This limitation for the present prevents its general introduction in place of water, but there are certain conditions under which it is the extinguisher par excellence.

In the hold of a vessel, for instance, nothing could be better. It would not affect the buoyancy of the ship, it would not damage the cargo in the slightest degree, and it would extinguish the fire as perfectly as an equal volume of water. In several instances it has been applied to this purpose. The perfect inclosure of the hull makes it possible to fill the hold with carbonic acid gas up to the very port holes, and, if these be closed, to the deck itself. The gas is readily produced by the action of acid upon fragments of marble or upon sodium carbonate. One plan proposed for the application of this extinguisher on shipboard consisted of having boxes with perforated sides for the escape of the gas, placed in different parts of the hold and connected by means of copper tubes with a carbonic acid generator. On the detection of smoke or fire, the acid is admitted to the marble or other carbonate in the generator, and the resulting gas permitted to flood the hold or such parts as are in danger. As it is half again as heavy as air, the carbonic acid gas would sink immediately to the bottom, and conflagration could soon be made impossible. The entire apparatus is simple and inexpensive. The materials for generating the gas are always easily obtainable, and cost very little. Had the Crystal been supplied with such an outfit, it is probable that the fire in her compartment could have been put out a few minutes after its discovery.

New Kind of Brick.

Messrs. Bleininger and Hasselmann, two German chemists, have, it is said, recently patented a method for obtaining products that will be more resisting to humidity, etc., than ordinary bricks and tiles. After drying and grinding the clay, they make a mixture as follows:

Clay	91⅓ parts.
Iron filings	3 "
Table salt	2 "
Potash	1½ "
Elder or willow wood ashes	2 "

The whole is heated to a temperature varying from 1,850 to 2,000 deg. C. (3,362 to 3,632 deg. F.). At the end of from four to five hours the argillaceous mixture is run into moulds, then rebaked in the ovens (always protected from the air) at a temperature of 842 to 932 deg. F. The product may be variously colored by adding to the above 100 parts: 2 parts of manganese for a violet brown, 1 part of manganese for violet, 1 part of copper ashes for green, 1 part arseniate of cobalt for blue, 2 parts of antimony for yellow, and 1½ parts of arsenic and 1 part oxdie of tin for white. These products resist the action of acids, and are well adapted for sewers, etc.

ACCORDING to the *Fireman's Journal*, some one advertised in a certain German local paper that another locality possessed a thrashing machine which was also very effective as a fire engine. The next number of the paper contained the following explanation: "Any one who advertises that at this locality we have a thrashing machine which can also be used as a fire engine is a liar, and even more, though he be as black and sooty as the devil himself; said advertisement is only for the purpose of ridiculing a mistake our noble fire brigade made at the late fire. They were in a great hurry, and in place of hitching their horses to the fire engine, they hitched them to a thrashing machine standing near, and drove quite a distance before they found out their mistake." And so it turns out not to be a combined fire engine and thrashing machine after all.

THE Holly Manufacturing Company, of Lockport, N. Y., have just completed the water works at Fond du Lac, Wis., and they have been very satisfactorily tested. The engines are two compound Gaskill engines, of 3,000,000 gallons each per 24 hours, and pump through 14 miles of pipe to 140 hydrants, etc. The water is taken from 4 six inch artesian wells 600 feet deep. The surplus from the wells is stored in an impounding reservoir of 2,500,000 gallons capacity, which is to be used for fire purposes only, and consumers are supplied direct from the wells. The contract test of throwing streams 120 feet high was perfectly successful.

PHOTOGRAPHIC NOTES.

The Best Temperature for Coating and Developing Dry Plates.—From some experiments recently made, which we find detailed in the *Photographic News*, we take the following interesting facts. Says the *News:*

It is a theory that has been often insisted upon by others as well as ourselves, that, the emulsion once evenly spread on a plate, the more quickly this sets the better; and there can be no doubt that slowness in setting produces deterioration in quality, probably because the bromide of silver has time to settle somewhat while the emulsion is still fluid on the plate, leaving an insensitive film of gelatine on the surface and a film of precipitated bromide against the glass, the latter wanting the protecting gelatine, and therefore liable to fog.

In coating in a room whose temperature was but little above the freezing point, we found that the emulsion at 100° F., a temperature about as high as we usually work at, poured on cold plates, set long before it was evenly spread.

In such a case, two alternatives are open to the operator. He may warm his plates and keep his emulsion at the normal temperature, or leave the plates cold and heat his emulsion to (say) 130° F. At this temperature it will readily flow over very cold plates.

We tried experiments to discover whether any difference in quality would be found in working by the two methods. We were astonished at the result. The plates coated on the glass slightly warmed were all that could be desired; those coated with the emulsion at a high temperature on cold plates were much slower in development, and showed a decided inclination to fog.

The time taken for the emulsion to set was about the same in both cases—probably not more than from one to two minutes—so time of setting cannot have been the factor which produced the deterioration of the plates. Nor can the emulsion itself have been spoiled by the mere raising of the temperature, because it was *after* the cold plates were coated with warm emulsion that, the emulsion being allowed to cool, warm plates were coated with comparatively cold emulsion.

It appears to us that the deterioration is produced by the contact of the atmosphere—probably not of either the oxygen or the nitrogen, but of some impurity in it—with a thin film of hot emulsion.

The more we work at plate making, the more convinced we become that the mere production of a satisfactory emulsion—one capable of giving plates of a high degree of sensitiveness, and possessing all other good qualities—is the easiest part of the process. The coating and drying of the plates form in reality the most difficult part of the work. The following few points may be laid down as established maxims in connection with plate coating and drying.

The plates should be coated with the emulsion at as low a temperature as will allow it to flow readily. After the plates are coated, the emulsion should be caused to set on them as quickly as possible. The drying should be conducted in a brisk current of dry air at a moderate temperature, and should never take more than twenty-four hours.

We were recently developing plates with the solutions very cold—probably the water was not above the maximum density point, say 40° F.—and, as was to have been expected, we found development exceedingly slow. This, however, we had not considered a disadvantage up till the time of our experiments, but we determined to try, by exposing two plates under the sensitometer, and by developing them with cold and comparatively warm solutions, to discover whether there was any real difference in result beyond the difference of time taken.

Here, for a second time, we were much astonished at the result of our experiments. We used iced—or rather snowed—water to mix the developer for the first experiment. It was quite a quarter of an hour before the developing action seemed to cease. Of course, we kept the plate carefully protected from light during all that time.

The second plate was developed with a solution of the same strength as that used for the first, but the temperature was raised to 60° F. The development in this case was complete in about two minutes. The two plates were fixed, and compared. The comparison was instructive. The plate which had been long in the cold solution was afflicted with stains and color fog to such an extent that, on placing it on a piece of white paper, the paper could not be seen at all through the parts that should have been transparent; the plate which had been developed rapidly in the comparatively warm solution showed the protected parts quite clear, and without stains of any kind. A temperature of 60° appears to be the best for all purposes.

With regard to the amount of detail brought out by the cold and the comparatively warm solutions, we may say that the advantage is slightly in favor of the latter, but not much, except when it is compared with solutions at a temperature so near the freezing point as is not likely to occur in practice. Solutions at 60° give an advantage of about one figure of the sensitometer over those at 40°.

Packing Exposed Plates.—Says Mr. Wm. Brooks on this subject in the *British Journal of Photography:*

For a long time past I have been making experiments with various materials for packing plates, which I think are successful. I am of the opinion that plain paper is bad for the purpose. For successful packing, the material used must be non-absorptive. By way of experiment, I perfectly dried some gelatin plates, and then placed between them some pieces of *papier* Joseph, and bound them together, and in twenty-four hours I exposed a plate and developed it, when it gave the structure of the paper, and I came to the conclusion that it was caused by the different degrees of humidity of the paper and the gelatin film, the humidity being equalized between the two; other papers also caused markings of a different kind under the same conditions. I then tried rendering the paper non-absorptive, by passing it through a thin alcoholic solution of shellac, using thin brown paper for the purpose, and then passing it through a rolling press, with good pressure to flatten it; this I found a great improvement; after plates being bound tightly together for a whole week, on developing no marking occurred.

I have tried various other substances successfully, namely, tin foil, lead foil, thin sheet gutta-percha; the latter seemed to answer the purpose better than any other material, being perfectly non-absorptive of moisture, and I should say perfectly inert to the most sensitive of films; it can be purchased at the chemists' sundrymen or at the gutta-percha warehouses in almost any large town, and can be used over and over again. I do not for a moment suppose that plate makers would adopt this mode of packing, but for photographers, both amateur and professional, it will be of great service, for, as a rule, plates *en route* are changed at night in the bedroom with but very little accommodation, and whatever method may be adopted, it must be expeditious. In summer time (dry weather), thin sheet gelatin can be used, such as is used for bonbons, without any color. Using gelatin is going to the other extreme, as it absorbs moisture with a vengeance; but I have found it answer, but give the preference to either the gutta-percha tissue or the shellac paper. I always prefer to cut whichever material I use as near the size of plate as possible. With care I have packed many plates with nothing between them without any damage occurring, but have kept them entirely under my own charge. The sheets can be carried in a flat tin box or a small portfolio of the size, or between two thick pieces of cardboard. I have every reason to believe that many plates are packed by the makers, in the pressure of business, almost hot, the outside papers they are packed in being of a much lower temperature, and any moisture given off flies to the films and causes stains, which seem unaccountable at times.

Appointment of a New Trustee for Stevens Institute.

We learn with pleasure that President Henry Morton, of the Stevens Institute of Technology, Hoboken, N. J., has been appointed to fill the vacancy in the Board of Trustees of the same institution caused by the death of Mr. Wm. W. Shippen.

In his letter announcing this appointment, Mr. S. B. Dod, president of the board, says:

"I feel that this is only your due as a recognition of your services and generous gifts to the institute."

President Morton has been at the head of this institution since its foundation, by a bequest of Edwin A. Stevens, in 1870; and, in addition to other smaller donations, he, in 1881, fitted up a new workshop at a cost of over $10,000, and presented the same to the institute; also, in 1883, he provided funds for establishing a department of applied electricity, devoting $2,500 to the purchase of new electrical apparatus and paying the salary of the professor appointed to take charge of the new department.

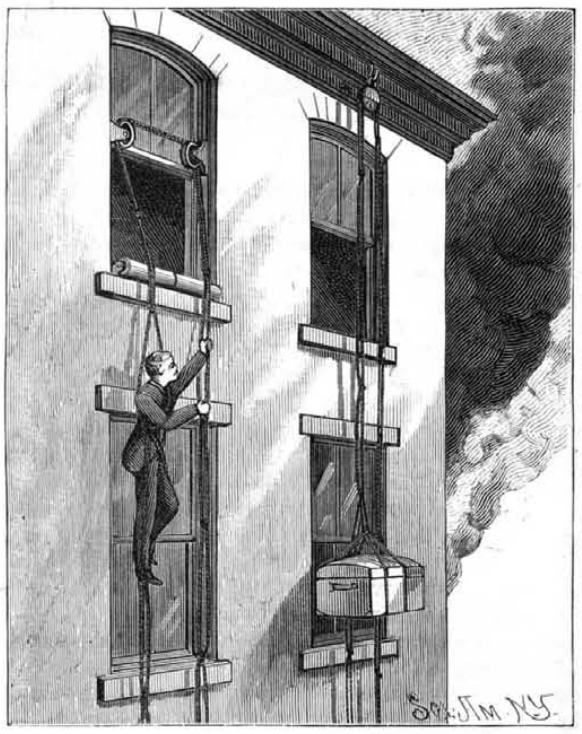
The Rabbit Plague in Australia.

Some time ago we published a statement of the ravages of rabbits in Australia, they having become so numerous and destructive that the authorities were alarmed, and puzzled to know how to get rid of the pests. It was stated that one of England's colonies had already lost two millions of sheep by them. One flock owner, it was stated, had trapped five thousand of the troublesome creatures, but that they were so numerous they must be killed by the million to perceptibly check the rapid multiplication of these prolific and devouring pests. In a recent English newspaper we see that, although Queensland has not as yet been afflicted by the rabbit plague, attempts are being made to prevent their ingress into their territorial limits by erecting rabbit-proof wire fences on their boundary line. Tenders have been accepted for 2,550 miles of fencing wire and 450 miles of wire netting of small mesh. The order will be shipped from England forthwith. A route has been laid out, running for a distance of 300 miles to the intersecting angle of Queensland and New South Wales, and thence northward for 100 miles. The Queensland government have voted £50,000 for this purpose. It is estimated that 1,300 miles of fencing will have to be laid in New South Wales; while in Victoria so great is the demand for wire that the authorities have signified a willingness to forego the duty upon it.

© 1886 SCIENTIFIC AMERICAN, INC

IMPROVED FIRE ESCAPE.

The fire escape herewith illustrated—for which letters patent have been granted to Mr. J. W. Wetmore, of Erie, Pa.—is extremely simple in construction, so that it can be readily understood and easily brought into use, is ready for use at once at the window of every story of the building along which it is suspended, and it may be used by persons in the building to descend without assistance, and also by firemen to ascend to any story. The device consists of two endless ropes knotted together at intervals to form loops from 1½ to 3 feet long. This double rope is passed around a pul-



WETMORE'S IMPROVED FIRE ESCAPE.

ley suspended either from a hook attached to the cornice or to the inside of the upper window. If desired, a hook may be placed at each side of the window and two pulleys be used, as shown in the left of the engraving. The person descending passes one of the links under his arms, and controls his descent by holding the other side of the rope. An auxiliary endless rope, which is first looped in one of the links of the double rope, may be used to raise persons or objects, and would be particularly useful in lowering a child that could not be safely held in one of the links. When the position of the pulley renders it necessary, friction rollers are placed on the window sill. It will be seen that the double rope can be operated from the window of any story or from the ground.

IRONING BOARD.

Secured near the under side of the head of the board is a transverse cleat designed to strengthen the board and prevent warping. Two short links are pivoted on the ends of a bolt passing through a block bolted to the board. The lower ends of these links are pivoted on the ends of a bolt secured in the lower leg of the board. This leg is made tapering, and is flat on its upper and lower surfaces, so that it can be used in

ELLISON & FEIGEL'S IRONING BOARD.

pressing sleeves or the legs of trousers. The upper end of the leg is extended beyond the links, and the extremity is finished obliquely to form a bearing parallel with the under surface of the main board. Several teeth are inserted in the bearing.

When the end of the main board is placed on the edge of a table, and the support is turned down to rest upon the floor, the upper end of the leg rises under the table edge, forcibly engages it, and holds the head of the ironing board in position. This fastening is made secure by means of a brace hinged to the main board, and when the lower end engages with one of a series of notches formed in the leg. The links allow a free adjustment of the lever support both in regard to the height of the table or bearing to which the ironing board is to be attached and in respect to the thickness of the bearing to which the clamp formed by the end of the board and the extension of the lever support is applied. One of the bolts passing through the block holds in place an iron holder shaped like a horseshoe and bearing the words "good luck." The board will not tip, neither will it tip the table to which it is attached, no matter what weight is placed on the projecting end.

Further particulars concerning this invention can be had from Messrs. Ellison & Feigel, of 38 South Diamond Street, Allegheny City, Pa.

Francis W. Bacon.

Francis W. Bacon, widely and favorably known as a mechanical engineer and expert, died in Boston, January 13, at the age of 76 years. He was a native of Southbridge, Mass., and served his apprenticeship in a Worcester machine shop. On becoming a journeyman, he worked some years in various New England cities, finally being forced by failing health to go to Cuba, where he remained three years as chief engineer on a sugar estate. Returning to the United States, he became associated with various business enterprises, and at the opening of the civil war was carrying on a machinists' supply store in New York. About this time he took up the steam engine indicator, which he was destined to do more to introduce into general use than perhaps any other one man. When first adopted, it was considered by the majority of engineers to be a mere scientific toy, of no practical value whatever. He believed in it, however, and suggested a number of improvements. To-day, thousands of the instruments are in use, their dictum being unhesitatingly accepted, not only in the engine room, but in the highest courts of the land. Mr. Bacon was a valued contributor to the SCIENTIFIC AMERICAN, the *American Artisan*, and the Boston *Journal of Commerce*. He was a member of the American Society of Civil Engineers and many other organizations, as well as a life member of the American Institute of New York.

Another Remarkable Gas Well.

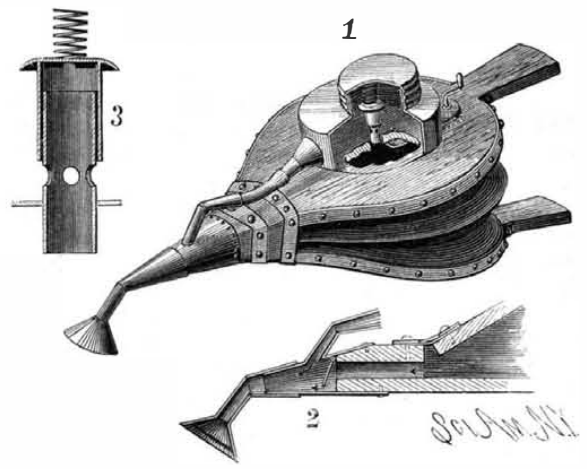
The *Sanitary Plumber* reports the greatest strike in natural gas yet made in Ohio, which occurred at Tiffin on the 19th ult. A well at that place was torpedoed with 400 pounds of rackarock and 25 pounds of nitroglycerine, at a depth of 156 feet. There were 300 feet of oil in the well at the time, and this was thrown to a height of 125 feet in the air, and was followed by an escape of gas, the flow of which Mr. Brownyear, the contractor, estimated at 600,000 feet per day, which would surpass any of Fidley's first four wells, and equal all of Bowling Green's combined. The shock of the explosion was felt in the most distant parts of the city, and thousands of people from the surrounding country hastened to the scene, led by a brass band, to welcome the new arrival. For the safety of the drilling apparatus the gas was piped a distance from the well, where it burned with great brilliancy, illuminating all the eastern part of the city. Over 200,000 feet of gas flowed during the night, and it is now steady at about 100,000 feet per day. Oil in considerable quantities for lubricating purposes has filled the well, and flows in a steady stream.

Proposed New Water Supply for Chicago.

A unique scheme for supplying Chicago with water has recently been proposed, and rests upon such plausible grounds that the Academy of Sciences has ordered an immediate investigation and report. A limestone strata underlies the city at no great depth, and outcrops in the bed of Lake Michigan, about two miles from shore. The stone contains numerous caverns and fissures which are filled with water from the lake, after it has percolated the intervening filtering courses. In a half a dozen wells which have penetrated the limestone formation, it has been found impossible to lower the water below the level of the lake, by the most persistent pumping. Based upon these observations, the plan of supplying the city with water by means of shafts sunk to the limestone has been proposed. It would take about $20,000, it is said, to make the experiment. Great care would be necessary to exclude all surface water and drainage contaminations.

IMPROVED BELLOWS.

The engraving represents a bellows particularly adapted for discharging insect powder on to trees or plants or about furniture, and also for blowing the loose sand from moulds used in casting metals, and for distributing facings over the faces of the moulds. The bellows is simple and durable, and is readily adjustable for its various uses. Secured to the top board of the bellows is a box for holding the pulverized substance it is desired to distribute. The box is connected with the bellows nose by a flexible tube, as clearly shown in the sectional view, Fig. 2. A wire gauze partition is fitted at the inner end of the box nozzle, to prevent choking up of the powder passages by lumps or foreign substances. The box is filled through an opening bordered by a screw neck upon which the cap fits. When the handles are operated to force the air through the nose of the bellows, some of the air will pass into the box through a check valve pressed down lightly by a spring. This valve (Fig. 3) is so constructed as to admit air to the box at two levels, thereby insuring thorough agitation of the powder in the box and a more effective distribution of it through the tube and into the nose, where it is met by the main air blast and ejected forcibly from the nozzle, which is, preferably, provided with a rose head. When the bellows is to be used to distribute foundry facings, the passage leading to the box can be closed by a valve on the inner face of the upper board when the facings are not to be blown



CAMPBELL'S IMPROVED BELLOWS.

upon the moulds—as, for instance, when the bellows is to be used for blowing loose sand from the moulds. This valve is operated by an arm on a crank lever pivoted in the board as shown in Fig. 1.

This invention has been patented by Mr. Geo. T. Campbell, of 935 Howard St., San Francisco, Cal.

CLOTHES DRIER.

This clothes drier, which can be attached to the wall of a room, consists of a sliding frame and folding drying rods, and is so constructed as to occupy but a small space and yet give a large surface for drying the clothes. The main frame consists of two uprights connected by cross bars and formed on their inner edges with vertical grooves, and provided with guides between which runs a sliding frame having grooved rollers. A rope attached at one end to the upper cross bar passes downward under a grooved pulley secured to the sliding frame, then upward over a pulley in one of the uprights, and then down the outside of the upright to a clamping lever. At the upper and lower ends of the sliding frame are wedge-shaped blocks turning on pivots. To these blocks are fastened strips having holes to receive the hooked ends of the drying rods, which are made of galvanized wire.

To use the drier, the upper wedge-shaped block is turned on its pivot into a horizontal position and fastened by a pivoted latch, and the drying rods are spread apart to receive the clothes. The lower block may be

BOGLE'S CLOTHES DRIER.

adjusted in the same way. The sliding frame with the blocks and drying rods is then raised to near the ceiling, where it is brought in contact with the warmer air of the room, by pulling the rope, which is then fastened by the clamping lever. The wedge shape of the blocks allows a compact folding of the drying rods. More than two blocks, provided with any number of rods, may be used, as desired.

This invention has been patented by Mr John A. Bogle, of Milton, Pa.

© 1886 SCIENTIFIC AMERICAN, INC

THE PRINCIPLE OF THE LOOM.

When a loom is seen in operation, the ingenious mechanism that causes it to act is admired, but it is difficult at first to grasp the fundamental principle involved. We shall therefore give a demonstration of the apparatus by one of the best methods imaginable, and this consists in the manufacture of a loom by ourselves and then weaving with it. Two lead pencils, a visiting or playing card, some thread, a good penknife, and a wooden paper-cutter are all the objects needed. The loom consists of two pencils to serve as warp beams, and of a heddle cut out of a piece of cardboard with a penknife. The outfit is completed by cutting one or two shuttles out of the same cardboard, and winding thereon the weft that is to be passed through the threads of the chain. The pencils having been placed on the edge of the table, and held in position by means of a heavy book, as shown in Fig. 2, we begin the operation of warping. This is done as follows: To one of the pencils we attach one of the extremities of the chain, and, by means of a large needle, pass the other extremity through the first slit in the heddle, then pass the thread around the other pencil and through the first aperture, then around the first pencil, and so on, until the last slit in the heddle is reached. After this, in order to weave, it is only necessary to raise and lower the heddle alternately, when, as may be easily seen, the only threads carried along will be those that run through the apertures. At each of these motions the shuttle must be passed between the two series of warp threads situated at different levels. A paper cutter may be used in lieu of a batten to push the weft home to the web.

This little apparatus, which may be easily and quickly constructed, will allow the mechanism of weaving to be perfectly understood, and may be considered both as an object of amusement and instruction. We got the idea of it from an analogous apparatus which is used on the government vessels for manufacturing what sailors call "sangle."—*La Nature.*

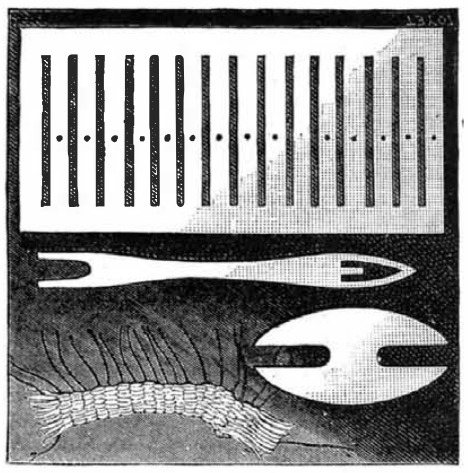


Fig. 1.—SHUTTLES AND HEDDLE MADE OF CARDBOARD.

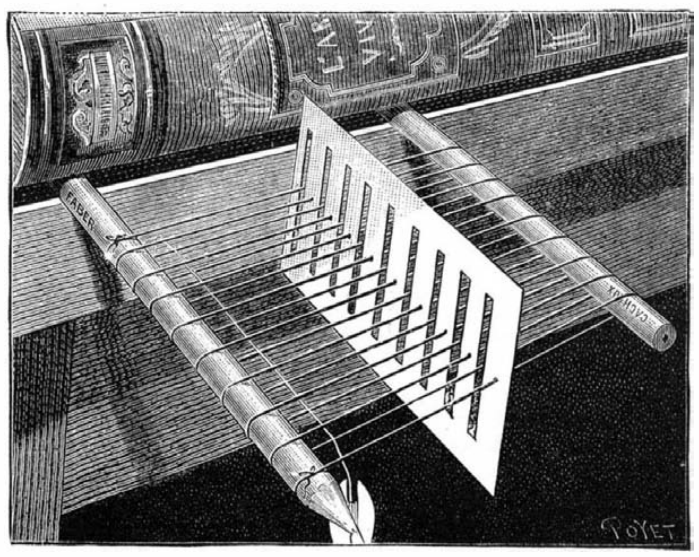


Fig. 2.—A SIMPLE LOOM.

BRICKWORK.

Although the strength of a wall or piece of brickwork largely depends upon the bonding of the bricks, little importance seems to be attached to it by builders in general. The essential requirements of good bonding in brickwork are mainly that no two vertical mortar joints shall come over one another, and that there shall be little or no cutting of bricks. The method of setting bricks here, which is very largely in use, is to lay the brick stretchers with a course of headers in every sixth course, so that we have in five courses the vertical joints over one another, thus violating the most important rule of bonding. In external walls, where the header course would injure the appearance, the custom is to run the stretcher courses right on at the face, the back being bonded in by cutting. Little can be said in favor of this method. It is supposed to be a "quick" bond, or one which can be quickly laid; but it is very doubtful whether the time saved is anything appreciable. The appearance is certainly not equal to the bond largely used in England, and known as the "Flemish," in which the bricks are laid header and stretcher alternately in the same course, and for strength it is decidedly inferior.

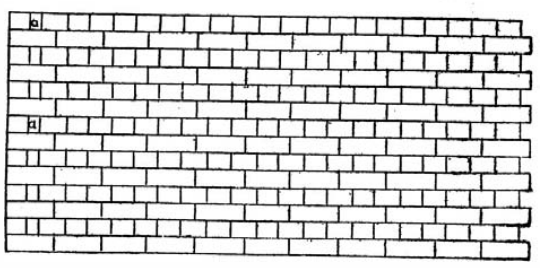
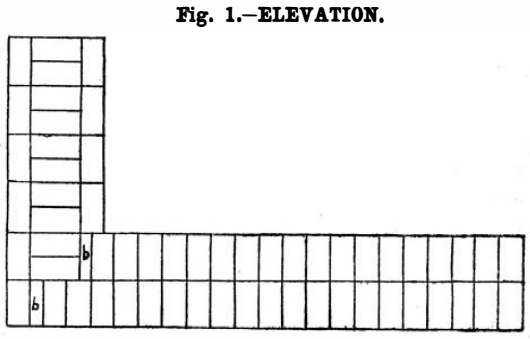
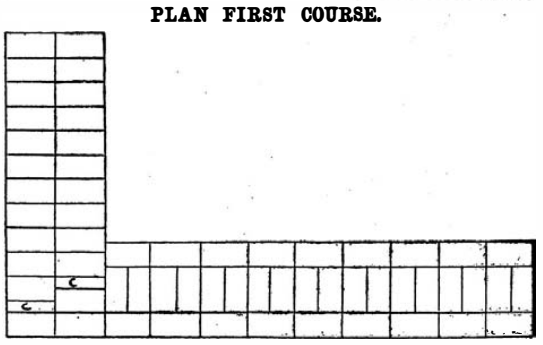


Fig. 1.—ELEVATION.



PLAN FIRST COURSE.



PLAN SECOND COURSE.

Probably the strongest and most convenient bond in use is that of which an example is shown in Fig. 1. In this we arrive as nearly as possible at the requirements of a good bond. There is little or no cutting required, excepting at the quoins, where a half brick or "closer" is used to close the course, as shown in the sketch, at *a a*, *b b*, and *c c*. There are no two vertical joints over one another throughout the wall, and there are a larger number of headers than in any other bond. It is in this fact of the large number of headers that the superiority of the bond mainly depends. A brick wall requires greater strength in the direction of its thickness than it does in the direction of its length. Most of the weight carried by the wall, such as the floor joists, roof timbers, etc., rests upon the inner portion, and the headers will have the effect of throwing this weight over the whole thickness of the wall. In building upon loose or soft foundations, artificial bond, such as hoop iron bond, is often introduced between the mortar joints to strengthen a wall longitudinally; but this could not conveniently be applied in the direction of the thickness.

The only possible objection to English bond that can be taken is in its appearance. It may be granted that, when compared to the Flemish bond, it is someway heavy, but certainly it is in every way equal to the running bond, while its strength is greatly superior.

WINDOW AND DOOR HEADS.

A very graceful and ornamental arch is that known as the Gothic elliptical, which is shown in Figs. 2 and 3. It looks equally well if carried out in brick or applied to stone for window or door heads, and is largely used in red brick and other buildings with a very excellent effect. In order that the appearance may be maintained, the curve should be carefully set out by rule. The following is the usual method: Divide the span, A B, into three equal parts at C and D. From A as center with radius A D describe the arc, D E. Then from C, D, and B, with the same radius, describe similar arcs. Draw lines from F and E, through C and D respectively, to G and H. Bisect the span at K, and raise a perpendicular, K J. Then the curve may be set out from center, C, for curve A to G, from D for curve B to H, from E for H to J, and from F for the portion of the curve from A to G, which will complete the curve of the arch. The bricks are rubbed in order that the mortar joints may radiate to the center from which each curve was struck, excepting at the crown of the arch, where they must be eased somewhat, the key brick radiating to K, and the following few joints to points between K and F and K and E respectively.

A. S. J.

Beer Brewing in New York and Brooklyn.

At the recent meeting of the American Society of Public Analysts, a paper was read by Dr. Otto Grothe on the brewing of beer as practiced in New York and Brooklyn.

Dr. Grothe had visited different breweries in both cities, and had analyzed different beers. As a result of his visits, he stated that bicarbonate of sodium was in extensive use by the brewers for neutralizing the acid, this substance being added in quantities varying from two to nine ounces to the barrel of 32 gallons. Grape sugar, glucose, and corn meal were extensively used as substitutes for malt, while hop substitutes could not be detected. Other substances found in breweries were juniper berries, isinglass, Iceland moss, cream of tartar, tartaric acid, salicylic acid, bisulphite of calcium, and glycerine. Licorice also is often sold to breweries, but it is not in general use. The beer is generally manufactured in much shorter time than in European breweries, and this is made possible by artificial clearing, done by adding a solution of isinglass and cream of tartar in water in the storing, *i. e.*, pressure barrel.

Large breweries effect the cooling of their cellars by ammonia ice machines, and they have done away with the cooling pan altogether. Smaller concerns work with natural ice, which is considered as disadvantageous in every respect. While some breweries are kept scrupulously clean, others are sometimes very dirty, mucor and fungi growing on the walls and tubs.

The beer often contains bacteria and bacilli, and the lactic ferment is very frequently found in the product from breweries where ice is used. *Saccharomyces apiculatus* often occurs, to the detriment of the stock. The only means for preventing loss are constant watchfulness and frequent examinations with the microscope. An entire change of the yeast may be necessary in some cases to avoid some hurtful ferment, which will make the beer "sick." As the salary of an expert master brewer is high, some dispense with such a superintendent, and, as occasion demands, call in a "beer doctor."

In beer, as at present manufactured, Dr. Grothe believes that danger to health may exist in the use of large quantities of sodium bicarbonate and in the excessive quantities of substances for cleaning the product, and he recommended that some legal limit should be put on the amount to be used. Dr. Bartley expressed the opinion that excess of bicarbonate of soda, or the presence of such ferments as would cause the beer to be technically called "sick," were the points calling for the special attention of officers of health.—*The Analyst.*

Cotton Batting for Water Pipes.

At the suggestion of Professor J. M. Ordway, a gentleman connected with the Boston *Herald*, during the last cold spell, took two pieces of water pipe, which he filled with water, and exposed to the weather, with the thermometer at 22°. One of these he covered with cotton batting, the glazed kind being the best, and the other he did not protect. At the end of two hours, the water in the unprotected pipe was frozen, while after an exposure of six hours the water in the protected pipe was still liquid. He says batting is easily applied, and should be put on to the thickness of from one to three inches, according to exposure. It can be held to the pipe by being wound loosely with twine, but should not be wound tightly.

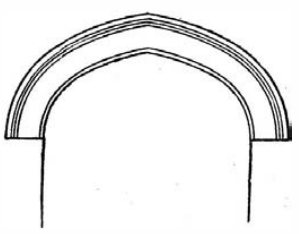


Fig. 2.—STONE WINDOW HEAD.

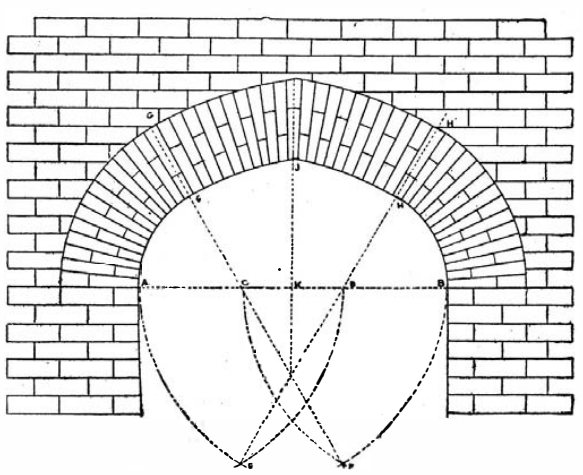


Fig. 3.—THE GOTHIC ELLIPTICAL ARCH.

© 1886 SCIENTIFIC AMERICAN, INC

THE MARVIN SAFE.

(*Continued from first page.*)

and the door interlock by the fit of the tongue of each one in the groove of the other, the tongues breaking joint with the frame and door. On its hinged side the door is provided with a heel tongue, or projecting flange, which extends along its entire side, from top to bottom, without a break. When the door is closed, this flange projects into a groove of corresponding size within the first step of the front frame, thus closing and breaking the entire joint between the door and frame at the hinged side. This construction acts as a protection against the action of fire, as regards the opening of the joints of the safe by the warping of its frame.

The inner face of the door is made with a recess sufficiently deep to receive within it a bookcase protector, which consists of a sheathing of material so treated as to render it highly non-conductive of heat. The protector is so placed as to form an air chamber, and thereby prevent any injury that might otherwise be communicated to the contents of the safe by the heated ironwork of the door. In order to obtain durability and strength in the hinges, they are made of annealed cast iron, and are securely riveted to the outside of the door and front plate, where they may be readily examined.

The Yale lock is placed next to the inner plate of the door, being connected with the dial on the outside by a small spindle running through a hollow tube.

These safes are usually furnished with a heavy plate iron inner door. The space between the inside and outside doors constitutes an air chamber most invaluable in preventing the induction of heat through the joints and over the flanges of the outside doors. The building of the frames and doors is done upon the fifth floor of the factory.

The most important material entering into the construction of a fireproof safe is the filling. This should be permanently effective—that is, it should not lose any of its heat-resisting qualities, no matter what may be the temperature of the office in which the safe is placed. Since, as is well known, "no injurious degree of heat can be communicated to the contents of a safe so long as the filling will give off steam at 212° F.," it follows that the property of generating steam or vapor is the most important of all considerations. The filling, which operation is carried on at the second floor, used in the Marvin safe is a mixture of asbestos, alum, and plaster, and it is to the good qualities possessed by this combination that the enviable record of these safes is largely due. Asbestos, while being indestructible by fire and highly non-conductive, can be reduced so as to retain its peculiar fibrous and interlacing or binding properties, and it is this form which is here used. It gives the required body to the plaster, enabling the latter to pack densely. It can be relied upon to bind the parts, and it affords the required clinging consistency to properly sustain the filling within the walls of the safe.

Alum is present because of its ability to give off vapor or steam; it contains over fifty per cent of water, which is liberated by heat.

Although the highly non-conductive properties of plaster make it useful here, it is introduced because of its power to absorb and retain large quantities of water. Its use prevents the dampness so destructive to ironwork of safes and to mechanism of lock, boltwork, etc., and effectually guards against the loss of fire-resisting qualities through the evaporation of the moisture from the lining.

On the fourth floor the burglar-proof work is done. This is made with solid wrought angle iron frames, welded at all corners, with alternating plates of wrought iron and five-ply welded steel and iron combined, or with an interlining of consecutive plates of welded steel and iron, making it impracticable for the burglar to drill the iron and then break away the steel. Each and every plate is confined to its place by heavy steel and iron screws, with heads pointing inward, and no two screws are placed in line with each other, all the plates being held together by heavy steel-headed conical bolts with nuts on the inside, over which the end of the bolt is riveted, thereby preventing burglars effecting an entrance by drilling or driving the conical bolts. The corners are all lapped with heavy, angle five-ply welded steel and iron. The conical bolts and steel plates are tempered drill-proof, and tested by drill under heavy pressure before leaving the factory.

Both the door and frame are stepped to fit each other, and in the face of each is formed a tongue and groove, so that when the door is closed there are two tongue and groove joints extending completely around the joint. In the bottom of each groove is a strip of felt which, when the door is closed, makes a perfectly air-tight joint. The door is hung upon double hinges, which permit each of its inner edges to be forced against the seat. Extending across the door is a bar journaled near each end in lugs projecting from the face of the door.

In the center of the bar is a handle arm, and at each extremity is an eccentrically placed pin; when the door is closed, one pin engages with a recess in a lug projecting from the frame, and the other enters a side projection on a sleeve moving upon a bolt passing through the two outer hinges. It will be seen that by turning this bar, by means of the handle, the door will be pressed into its seat. The bolts are then shot out to lock the door. The spindles of the lockwork and boltwork are made drill-proof, and are built into the doors with a steel hub, so as to make it impossible to draw, drive, or drill them, thus giving ample protection against gunpowder or other explosives.

When required, vault doors (which are made on the fourth floor) are constructed both fire and burglar proof. The outer door is then made of compound five-ply welded chrome steel and iron, two inches thick and secured by round polished bolts shooting out on all sides into a bolt frame of heavy bar iron, and locked with a Yale combination lock. The inner doors are made of heavy boiler iron, and secured by up and down bolts and Yale lock.

On the floor next to the top is the woodworking department, in which the interior of the safe is partitioned and provided with drawers, and in some cases the outside covered with cabinet work. Through the center of the building extends a shaft in which is an elevator capable of carrying the largest safe. The many fine horses which deliver the safes in and about the city are stabled on the third floor.

From the shipping yard shown in Fig. 1 the safes are taken to the commodious salesrooms of the Marvin Company, at No. 265 Broadway, this city, shown in Fig. 2.

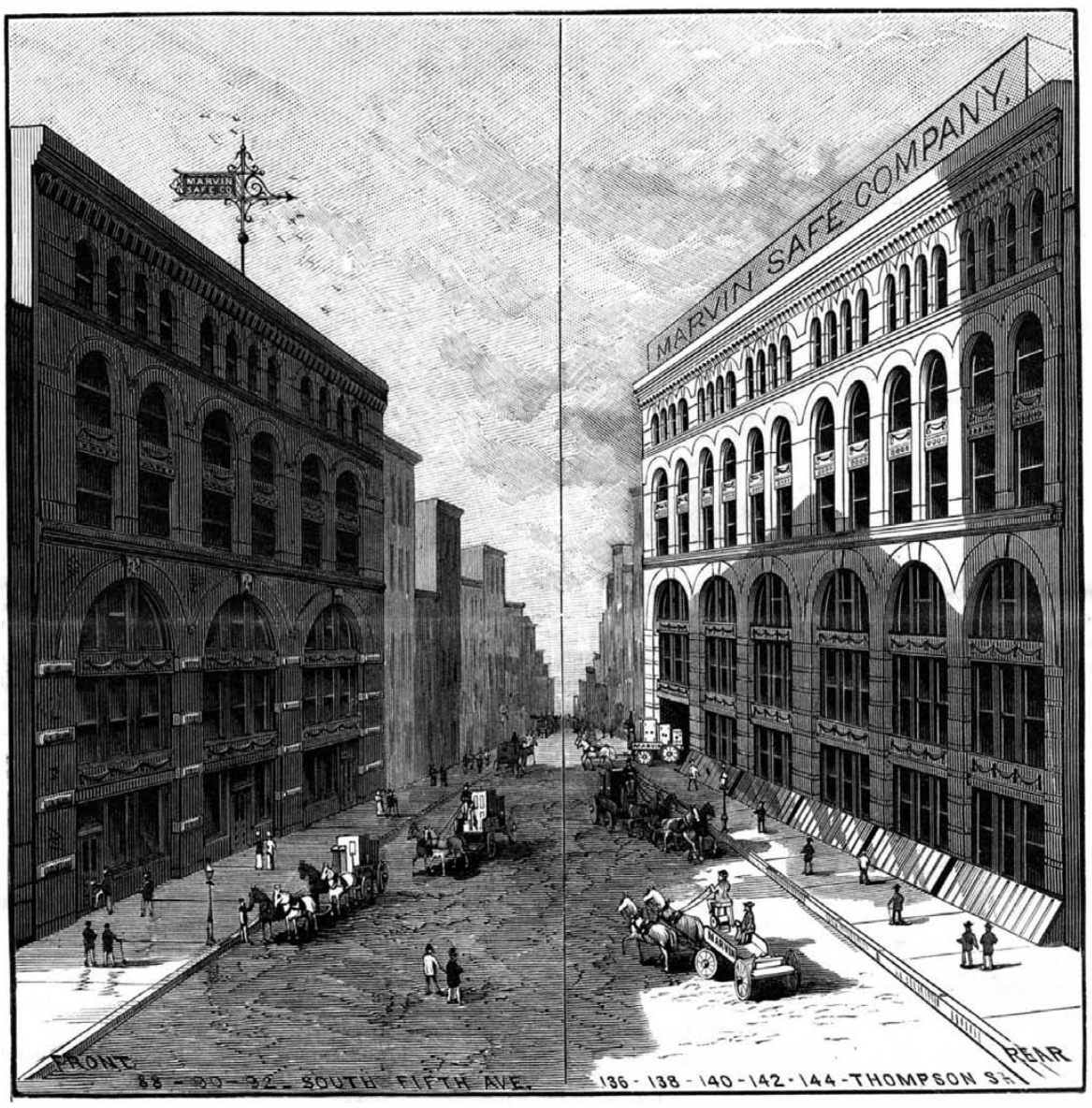


Fig. 3.—MARVIN SAFE COMPANY.—FRONT AND REAR VIEW OF THE NEW FACTORY.

Photography of a Tiger and His Prey.

A photograph of a tiger in the act of seizing his prey has, through a lucky accident, been secured by an Englishman in India. His camera happened to be focused on a buffalo which was tied to a stake some thirty feet away. A dry plate had just been put in place when a tiger leaped from the jungle, and with a single blow prostrated the buffalo. The circumstances were rather trying to the nerves of the operator, but he retained his presence of mind sufficiently to release the shutter before beating a hasty retreat. Some little time passed before he found it convenient to examine the result. Though the negative was poor, it gave a good idea of the relative positions of tiger and buffalo, and confirmed the generally accepted belief that the tiger, with his one knock-down blow, endeavors at once to dislocate the neck of his victim.

The Crank Defended.

What would we do were it not for the cranks? How slowly the tired old world would move, did not the cranks keep it rushing along! Columbus was a crank on the subject of American discovery and circumnavigation, and at last he met the fate of most cranks, was thrown into prison, and died in poverty and disgrace. Greatly venerated now! Oh, yes, Telemachus, we usually esteem a crank most profoundly after we starve him to death. Harvey was a crank on the subject of the circulation of blood; Galileo was an astronomical crank; Fulton was a crank on the subject of steam navigation; Morse was a telegraph crank. All the old abolitionists were cranks; the Pilgrim Fathers were cranks; John Bunyan was a crank; and any man who doesn't think as you do, my son, is a crank.

And, by the bye, the crank you despise will have his name in every man's mouth, and a half completed monument to his memory crumbling down in a dozen cities, while nobody outside of your native village will know that you ever lived. Deal gently with the crank, my boy. Of course some cranks are crankier than others, but do you be very slow to sneer at a man because he knows only one thing and you can't understand him. A crank, Telemachus, is a thing that turns something, it makes the wheels go around, it insures progress. True, it turns the same wheel all the time, and it can't do anything else, but that's what keeps the ship going ahead. The thing that goes in for variety, versatility, that changes its position a hundred times a day, that is no crank; that is the weather vane, my son. What? You nevertheless thank heaven you are not a crank? Don't do that, my son. May be you couldn't be a crank if you would. Heaven is not very particular when it wants a weather vane; almost any man will do for that. But when it wants a crank, my boy, it looks very carefully for the best man in the community. Before you thank heaven that you are not a crank, examine yourself carefully, and see what is the great deficiency that debars you from such an election. —*Bob Burdette.*

Digestibility of Cheese.

Klenze.—Of the eighteen varieties experimented with, Cheddar was digested in the shortest time (four hours), while unripe skim Swiss cheese required ten hours for solution. There is no difference in the digestibility of all sorts of hard cheese, or all soft cheese, but all fat cheeses are dissolved the most rapidly, because, being open by reason of the fat, they are the more readily attacked by the solvent. There is no connection between the digestibility and the percentage of water present in the cheese, but there is some connection with the percentage of fat and the degree of ripeness. From examination of the quantity of nitrogen dissolved, the author concludes that, on account of its great digestibility, cheese is the most nourishing of all foods, meat and eggs excepted.—*Jour. Chemical Society.*

© 1886 SCIENTIFIC AMERICAN, INC

Correspondence.

An Opportunity for Inventors.

To the Editor of the Scientific American:

The "new steam carriage" of French invention, described in the SCIENTIFIC AMERICAN of Jan. 9, and all similar vehicles, are of profound interest to the American people. Our towns and cities are filled with people who will not keep a horse, not because of the *first cost*, but because the horse is a heavy *continuous* expense, when idle as when in use. For a vast majority of people, this objection is fatal where a vehicle is desired mainly for pleasure purposes. No such objection applies to a steam carriage; with it the expense ceases with the journey.

The weight of this French carriage and the attention of a stoker are grave difficulties in the way of its general introduction. Let some of our clever inventors overcome these difficulties, and he will enrich himself, besides conferring a blessing on the millions. The employment of a small engine using oil for fuel might be a simple solution of the whole problem.

The wants of tens of thousands of our people would be fully met by a vehicle capable of a journey of ten or twelve miles without further additions to the initial charge of motive power. The writer has long been of the opinion that a couple of iron or steel cylinders of very moderate dimensions charged with strongly compressed air and mounted on a light vehicle would answer every purpose.

It is to be seriously hoped that the entire problem will receive from our inventors the earnest attention which it so richly merits. B.

Columbia, S. C., Jan. 18, 1886.

Danger from Steam Pipes.

To the Editor of the Scientific American:

As there have been several articles in your valuable paper of late with regard to the danger of steam pipes in contact with wood or other inflammable substances, I thought the following might interest some of your readers.

We introduced steam heat in our house in the autumn of 1857. Several years later, the pipes in the cellar were inclosed in a box filled with sawdust, while at a distance of from fifteen to thirty feet from the furnace they were also wrapped with what appears to have been a woolen blanket cut into strips.

On taking down the boxing and sawdust, several days ago, I found the woolen wrappings charred on the inside, where they came in contact with the pipe. The sawdust had settled so as to leave the pipe bare, and above it the top of the box was considerably scorched, although the space intervening was from half an inch to an inch.

In one place, where an inch board was jammed tightly between the pipe and the floor above, it was very much charred, being converted completely into charcoal on the surface. The steam pressure is never over four or five pounds at the most, and is generally much less.

The size of the pipe is two inches in external diameter. I send you specimens of the woolen wrapping and board. WM. TATNALL, JR.

Wilmington, Del., Jan. 23, 1886.

Mind Cure.

To the Editor of the Scientific American:

I have just read a very interesting and well-reasoned article on the "Mind Cure," in the SCIENTIFIC AMERICAN of the 16th inst. For years I have made experiments on the subject, and had, in many cases, obtained striking results where the patients were uneducated people. It appeared so difficult to account for these results that I could scarcely credit the evidence of my own senses, until a medical friend, instead of laughing at me, as I expected he would, handed me a book out of which I send some passages which may interest those of your readers who follow up the question.

It is one of the clinical lectures on the principles and practice of medicine delivered by John Hughes Bennett before the Edinburgh College of Medicine, and the official position and responsibility of the lecturer must add weight to his utterances.

He speaks of the mind cure as the influence of predominant ideas on the body, and calls it "monoideism," and goes on to say: "In all the cases of relief, there can be little doubt that any benefit that did occur may be attributed to a strong belief, on the part of the patient, in the efficacy of the means employed. In recent times, more systematic attempts have been made in this way to relieve pain. This subject, however, is yet in its infancy, and has to be separated from the charlatanism which has hitherto been mingled with it. The labors of Dr. Eisdale among the natives of India and of Mr. Braid in Manchester exhibit a worthy commencement to the rational treatment of disorders by the means now alluded to, and there can be little doubt that, in no long time, its influence, when further studied, will be acknowledged. But how far this influence is dependent on the confidence of the patient, on the belief of some mysterious circumstance which is presumed to produce the effect, or on some unknown law regulating function, through the mind, further observation alone can determine."

Then Bennett goes on to say that the phenomena are wholly occasioned by predominant ideas in the individual, by suggesting thoughts to patients in various ways—definite physical impressions, etc. He says that remarkable cases have been met with, where a judicious application of this system has removed insomnolence or various kinds of pain, spasms, and other evidences of excitement; where hysterical paralyses of the limbs or special organs of sense have been *relieved* or *cured*, and where the torpid functions of lactation, perspiration, defecation, menstruation, etc., have been rendered more active.

That is the summing up of Bennett's lecture. The mere fact that it was delivered to the students of a great medical college by one responsible for the orthodoxy of his opinions ought to secure for the question of "mind cure" a serious and earnest consideration, when, in Bennett's own words "there can be little doubt that in no long time its influence, when further studied, will be acknowledged." H. G. JOLY.

Quebec, January 19, 1886.

A New Source of Selenium.

To the Editor of the Scientific American:

The success of Mr. Ch. E. Fritt's recent experiments with curved gold leaf and thin homogeneous plates of selenium for converting the sun's rays into electrical energy, also Crooke's experiments with the radiometer, and the many half successful and half completed experiments made by others in this direction, suggest the strongest possibilities of an unexplored field of great value, in which solar electricity is to play a prominent part. Selenium has been found to possess strange actinic properties, not yet half understood, even by the most persistent experimenter.

Owing to the scarcity and high cost of this substance, these investigations have not been pursued to the extent that is warranted by the success thus far attained.

The SCIENTIFIC AMERICAN rightly refers to flue and chamber deposits of sulphuric acid works using pyrites for acid making as a possible source of supply of this valuable substance. In this connection I am able to point out a source of supply in our own country that should be ample to furnish all that is needed for experimental purposes, if not for extended use. All pyrites contain traces of selenium, which accumulate in the flues and lead chambers of the acid works in sufficient quantity to color the deposit red. In most cases the quantity of selenium in the ore is too small to estimate. The Milan mine, of Milan, N. H., however, contains selenium in its ores in very appreciable quantities, in fact, from 0·02 to 0·25, and even in some samples 0·5 per cent is found. Sulphuric or nitric acid solutions of the ore invariably yield the peculiar rose red color of selenium, and acid chambers running on this ore accumulate large quantities of selenium oxide. Strong sulphuric acid precipitates selenium; consequently, it may be obtained from the settling tanks of the acid works in very pure condition. No arsenic is present in the ore, as is usually the case, and the selenium is free from this nuisance, although some of the rarer metals may be there.

Tests of the selenium mud and deposits are now being made, and I hope to be able soon to report fully upon their composition. Since many acid works are using this ore, it will not be long before the selenium can be obtained in quantity. In the mean time, the Atwood Lead Co., of Portland, Me., will be glad to furnish samples of the mud for experimental purposes to any one who will take the trouble to send for it.

In this same connection I may be allowed to suggest that analytical chemists, spectroscope experts, and all those who wish to investigate and search for rare elements and possible new ones, will find these same flue and chamber deposits a subject quite worthy of their attention. F. L. BARTLETT.

Portland, Me.

Proposed Method of Firing Dynamite Shells.

To the Editor of the Scientific American:

A few weeks ago you published an article describing the "Pneumatic Dynamite Gun," accompanied by an excellent engraving. The device appears to be a well-planned, elaborate affair, but at the same time presents some objectionable features, such as being too bulky, and the liability of the disarrangement of some of its complex machinery. Of course, it is understood that the only difficulty in this matter is to start the projectile by a gradual and increasing force, so that it will not explode in the gun by concussion. Could not this objection be overcome by an arrangement of cone-shaped powder chamber with an expansion room behind the shell charged with dynamite?

My plan is to use a slow-burning powder and to ignite the cartridge at the forward or small end by a vent, electricity, or a needle and cap. When this takes place, the first gases of explosion, which cannot be of great volume, owing to the small area of the neck of the chamber, are allowed to expand, so that the projectile is not subjected to a violent shock in starting. As it moves away from the breech, the space behind it is more rapidly filled by the gases on account of the increasing surface of the burning powder, therefore it is constantly impelled by an additional force, until it leaves the muzzle at about the speed of an ordinary cannon ball.

I would make my gun only slightly longer and much lighter than ordinary cannon. The shell should be long, with its greatest weight in the front end, so as to require little or no grooving of the bore. As there would be no sudden rebound, a light carriage could be used. S. E. WORRELL.

Hannibal, Mo., Dec. 30, 1885.

The Birds and Gold of California.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of Dec. 12, C. F. Holder contributes an article under the head of "Candelabra Cactus and California Woodpecker," in which he relates the observations of himself and others on the peculiar instincts of the California woodpecker in regard to storing his future supply of food where it will be safe against the destructive effects of the elements and the depredations of other animals. I do not think the woodpecker is singular in his industry and ingenuity in providing for his future wants. The greater number of animals exhibit a like power of reasoning and judgment in their efforts to provide for themselves and their young. In fact, they display qualities in this respect that might be imitated with great advantage by a large class of the human race. The goodness and wisdom of the Creator are seen in the fitness of things throughout creation, the nice adaptation of those qualities in every created thing suited to its enjoyment, perpetuation, and preservation.

I had a favorable opportunity to observe the peculiar habits of the California woodpecker while mining in the Sierra range of California. An incident will fully illustrate what I wish to say. Early in the fall of '50 I noticed a red-headed woodpecker, such as we have in the Middle States, busy from daylight to dark digging holes in the bark of a pine tree near our cabins. At my first leisure I visited the tree, expecting to find the bark infested with worms, but to my surprise I found it studded with acorns, but not protruding from the holes. The holes ran in regular lines around the tree, beginning about four feet above the roots and extending to the height of fifteen feet. The holes were dug with mathematical precision. The acorns were driven in *large end foremost* (the contrary end put forward by Mr. Holder's bird), and the fit was so exact that no agency could remove them without cutting away the bark. No miser worked more incessantly or hoarded with greater care. When the rain confined us to the cabins, he continued at his work, laying up his treasures with persistent industry. As soon as he had pecked out a hole, he flew to an oak and selected an acorn, sometimes from the ground, at others from the tree, to fill the place; and so perfect was his organ of size that I never saw him get one too large to go in, or so small that he did not have to hammer it to its place. The incident would be incomplete without giving the sad part of it. The persistence of his character would otherwise never have been known. Wishing to reload my rifle, preparatory to a deer hunt, I stepped out of the cabin to discharge it. The bird, as he labored on the side of his tree, made a tempting mark, but too distant, I thought, to be in danger; but it proved otherwise. I walked sadly down to the tree and picked up his remains, and to my surprise I found that he had worn down his upper bill to the raw flesh.

Frequently afterward I noticed magazines of acorns stored in the pine bark and some in the oak. They were put in to stay, and when the woodpecker wanted his dinner, he took it on the *whole shell.*

In the same number of your paper, Mr. C. H. Chase, of Bridgewater, N. S., makes the statement that the "first gold found in California, by James Marshall, was in the limits of the present city of Marysville, on Feather River, and not on the Sacramento." The history of Marshall's discovery of gold in California is as well established and the location as well defined as the old "Plaza" in the city of San Francisco, and is not located at "Marysville on Feather River," nor on the "Sacramento River," but at Coloma, on the south fork of the American River, where Marshall was erecting a saw mill for Mr. Sutter. The mill was being built on a bar in the river, and when the water washed over the smooth, hard rock in the bottom of the tail race, carrying off the gravel and sand, the gold lay exposed to view in the little fissures of the rock.

The mill was never completed, but was in a good state of preservation when the writer saw it, two years after its erection. PAUL OLIVER.

Perryville, Ashland Co., Ohio.

British Bayonets.

The *London Times* says that on a recent test of several thousand bayonet now in use in the British army, being a fair representation of the quality of all, thirty-three per cent were found to be useless, for lack of stiffness and temper.

© 1886 SCIENTIFIC AMERICAN, INC

IMPROVEMENTS IN ELECTRO MAGNETS.

A new form of electro magnet has been designed by M. Recordon, and has been made to serve as the basis of several kinds of electric apparatus, including induction coils, electric bells, and motors. We take the following, with our engravings, from *Engineering:*

It is formed of an iron tube, T, with flanges of the same material, and on each flange there is made a flat, *m*, which represents the pole. To one flange there is joined a piece of iron, E, with an extension which serves to carry forward the lines that force, and so produce an approximately uniform magnetic field for a short distance beyond the pole, *m*. To the other flange there is attached an iron hinge, G, to which the armature, A, is pivoted, and thus the magnetic circuit is rendered continuous. The attractive force upon the armature continues almost constant from the position shown in Fig. 1, until the armature touches the pole, *m*, the length of this distance or stroke depending on the thickness of the armature. In large magnets it may be 5 centimeters (2 in.), and as there is a very considerable attraction beyond this limit, it will be seen that a long stroke may be obtained. As an example of the strength of these magnets, we may give the dimensions of one which will sustain a pull of 110 lb. on the magnet when excited by the current from these Leclanche elements: Length, 6¼ in.; diameter of flanges, 2·4 in.; bore of tube, 1·3 in.; wire, No. 16.

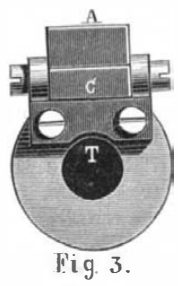


Fig. 3.

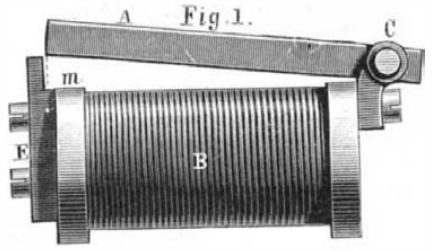
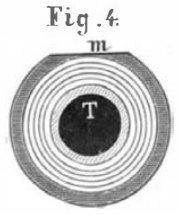


Fig. 1.

Fig. 4.



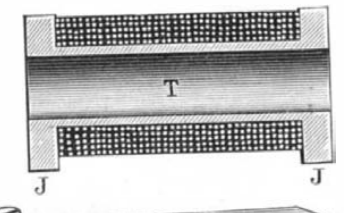


Fig. 2.

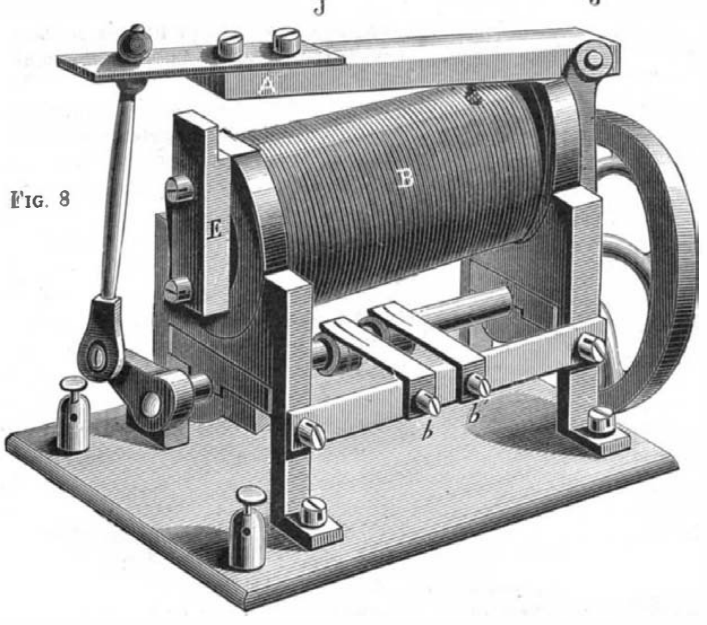


FIG. 8

IMPROVED ELECTRO MAGNETS.

Fig. 5 shows an induction bobbin based on this principle. It is entirely of iron, and is fixed on a wooden base-plate. The ends of the primary coil are connected to the terminal, *b*, and the column, D. The secondary wire is connected to two other terminals, which are hidden in the engraving by the bobbin. In order that the current may not strike through the insulator to the flanges when the tension is very great, two thin disks of wood are placed on the inner sides of the flanges, and the wire is wound between them. The make and break is produced by the armature, A, which vibrates opposite the flanges of the bobbin in the well known way. The rate of its oscillation is controlled by the weight, P. The instrument shown in the figure has the following dimensions: Diameter, 3·27 in.; thickness of flanges, 0·2 in.; exterior diameter of cone, 1·6 in.; interior diameter, 1·4 in.; distance between flanges, 1·7 in.; the primary wire weighs 216 grammes, and is 1 millimeter (0·04 in.) in diameter. The recording wire weighs 145 grammes, and is $\frac{17}{100}$ of a millimeter (No. 32) in diameter; it is laid in 31 layers. It is said that this bobbin produces results which are exceedingly striking in relation to its size.

FIG. 5.

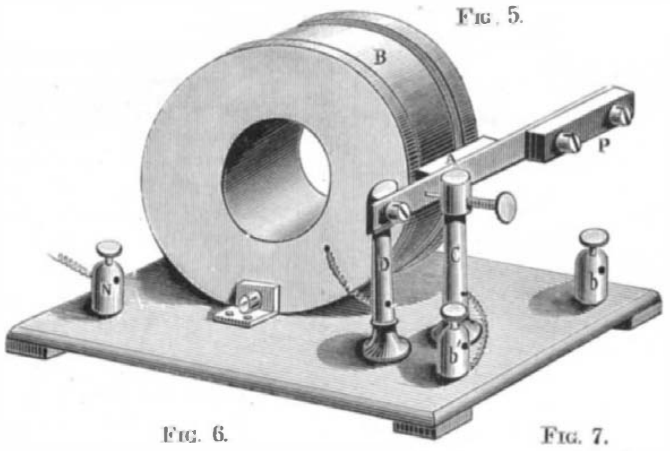


FIG. 6.

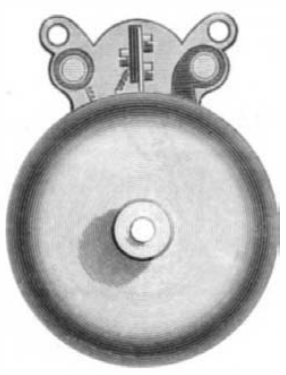
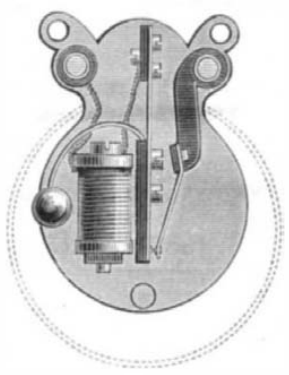


FIG. 7.



An electric bell constructed on this system is shown in Figs. 6 and 7, where it will be seen that great simplicity is secured, together with a very rigid construction.

A rotary motor suitable for light work is illustrated in Fig. 8. The armature is coupled by a connecting rod to a crank upon a shaft which carries a flywheel and a commutator. The commutator is so arranged that the magnet is excited when the crank arrives at the top of its stroke, and the circuit is broken at the other extremity of the travel.

PAPER of proper thickness is rendered transparent by soaking in copal varnish. When dry, it is polished, rubbed with pumice stone, and a layer of soluble glass is applied and rubbed with salt. It is stated that the surface is as perfect as glass.

Improved Reservoir Construction.

At Tunbridge Wells, near London, a new reservoir has been constructed, capable of holding 45,000,000 gallons of water. In the construction of the reservoir, some new methods were adopted, which will be likely to interest many persons engaged in such work. Eight acres of land was secured for the site, and the walls take up one acre, leaving seven acres covered with water. The excavations necessitated the removal of 120,000 yards of earth, which was used in the construction of two artificial embankments, each 156 feet thick at the base, and 27 feet deep, having a bottom surface of 21,418 square yards, which is concreted to a depth of 12 inches, while the slopes measure 13,222 square yards, and concreted with an average of 9 inches, the whole surface of concrete being afterward covered with asphalt.

At a dinner recently given to Mr. W. Brentnall, the engineer of the work, on its completion, in course of his remarks he said: "There are some features of engineering interest in connection with these works. I will mention two only, which will perhaps allay the fears some may have as to the stability of the embankments. Storage reservoirs are usually so constructed that one artificially made embankment is required, which is built up in thick layers of earth of 11 inches to 2 feet in thickness, tipped loosely from barrows or wagons, and consolidated by its own weight (a very uneven and imperfect consolidation, taking an indefinite length of time), a clay puddle wall in the center of the embankment being relied on for water tightness. This sometimes fails, with most calamitous results. I made a wide departure from the ordinary method of construction, just explained, in constructing the embankments in layers of earth fresh from the excavation, laid only 6 inches thick, with a little water added, and then rolled and cross rolled with a steam roller until each layer was reduced to about 3½ inches thick. By this method the embankments were at once consolidated equal to original earth, no subsidence whatever taking place, as is proved by the brickwork erected upon it remaining perfectly sound. Indeed, so perfect was the consolidation that, when the men were required to move some of it, it was like a piece of rock, and had to be picked out. The reservoir is, in fact, unique in this respect, and in that it has a culvert running through the center of it. This culvert is necessary, in order to carry the surface water which generally flows through the valley to the Medway. This again necessitated extra cost, and involved great forethought, for it had to be constructed so that it should carry an immense weight. It passes directly through the center of the two artificial embankments, and thus underneath the whole length of the reservoir. I am glad to say that my example of embankment construction has been followed in the north of England by an engineer of eminence, who is constructing a reservoir with an embankment upward of 100 feet high, the rolling alone costing close on £6,000, which is money well spent, as the work is at once consolidated and the stability of the bank insured. Another wide departure from the ordinary method of construction was the adoption of an inner skin or layer of asphalt as the watertight material, in lieu of clay puddle, and to my mind there are several advantages in the adoption of asphalt. It is quite as cheap as clay puddle; should a leak occur, it can easily be found and stopped; it will prevent the growth of vegetable matter, and there will be no risk of the slopes being damaged by waves in rough weather. It has also a clean and neat appearance, and forms a fitting receptacle for filtered potable water. This plan of asphalting has also been adopted by an engineer in the construction of a reservoir to hold twelve million gallons.

The Alcoholic Value of a Bushel of Corn.

The *Milling World*, in answer to a correspondent, who calls in question the accuracy of a previous statement in the same paper on the percentage of our cereal crop used in distilling, gives the following curious statement of the value of a bushel of corn when converted into an alcoholic beverage:

Let our correspondent, says the editor, trace a bushel of corn, for instance, from the field to the drinker's glass. The grower works at least two hours in raising a bushel of corn. He sells the bushel for 30 cents on his farm. He spends the 30 cents for two drinks, thus parting forever with his corn.

Now follow the corn. It cost 30 cents, and is turned into seventeen quarts of intoxicating drink. The distillers receive 40 cents a gallon for converting it into whisky. The corn in its changed shape represents the original 30 cts. and the $1.70 for the distiller, making its value at this stage $2. Then the government tax of 90 cents a gallon adds $3.85 to the value, swelling it to $5.85. The bushel of corn now passes on to the jobbers, salesmen and wholesalers, and through them to the retailers. By the time it has reached the retailers it has been "reduced" in strength and increased in quantity by the admixture of water and other more harmful substances, so that its measure has at least been doubled, and the corn, when it begins to drop into the drinkers' glasses on the bar, represents about 8½ gallons of drink.

Allowing sixty drinks to the gallon, the official bar average, the bushel of corn will furnish 270 drinks, which, at an average of 15 cents to the drink, will take $40.50 from the pockets of the consumers. This, added to the $5.85 put into the corn up to the time of reaching the jobbers, makes a total of $46.35. Subtract the 30 cents which the farmer received for the corn, and the balance, $46.05, will show the amazing profits made by those who do not till the soil to grow the corn, but who multiply infinitely by scientific means the mischievous powers of the grain, and who from this hurtful multiplication reap easy, large, and reliable profits. The original price of the bushel of corn is contained 155 times in the ultimate receipts from it. In this way the enormous wasting power of alcoholic drink can be easily understood. Our correspondent can follow a bushel of oats, rye, barley, malt, or wheat from the producer to the consumer through the same channel, and in each instance his computations will satisfactorily answer his questions.

Silvered Glass Balls for Signaling.

The silvered balls frequently seen in gardens are advocated by Mr. Hatt, in a note to the French Academy of Sciences, for heliographic purposes, in preference to plane mirrors. Their advantage lies in the greater intensity of the luminous point, which can therefore be seen to greater distances. From experiments made by him during the past summer, he found that with a sphere of small diameter the image perceived at 15 kilometers with a lunette had a splendor comparable to that of a star of the second magnitude in a field feebly lighted. Such an image, which can be produced at little expense, would, he thinks, be useful in topographical triangulation.

© 1886 SCIENTIFIC AMERICAN, INC

THE BULLFROG. (*Rana catesbiana*, Shaw.)

BY C. FEW SEISS.

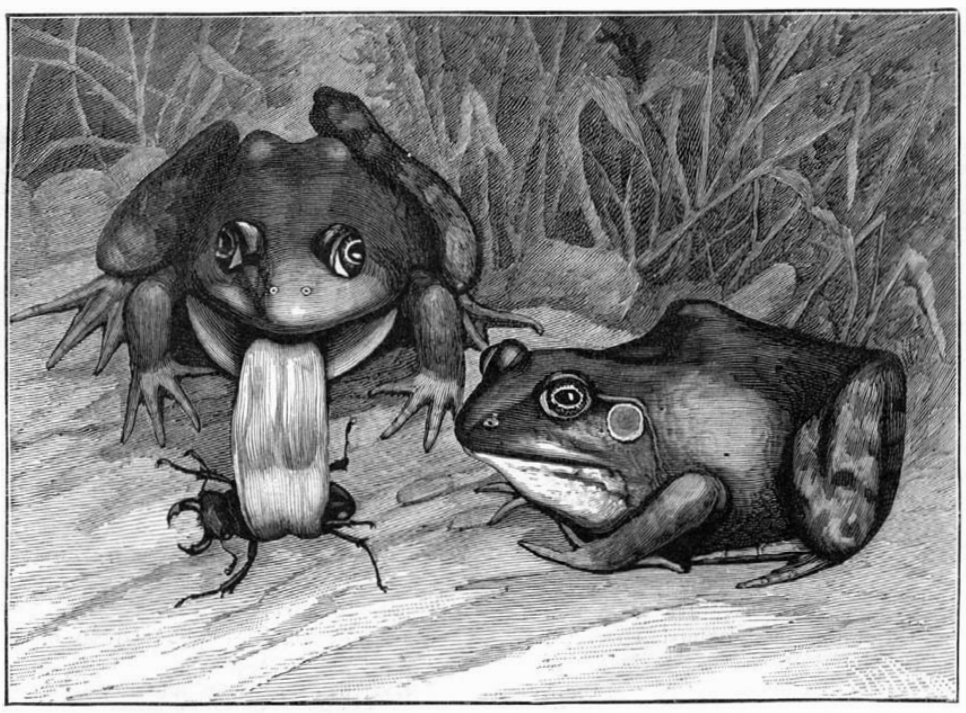
In the first warm days of early spring, the bullfrogs quit the mud holes in which they have slept during the winter, and often congregate at ponds and still, muddy places along streams of water. Here the sexes unite, and the female deposits her spawn. The eggs hatch in a few days, and the young frog enters his tadpole stage. Some of the tadpoles, when food is abundant and circumstances are propitious, develop legs, lose their tails, and become perfect frogs before cold weather sets in; but others remain in the tadpole state until the second year, as I have found large tadpoles of this species with well developed legs in the early spring. Dr. Garnier says it always takes two years for the larvæ to mature in Canada. The tadpoles of this frog are large and stout; color, olive or gray-green above, the tail with scattered black dots, and white beneath. Before the fore legs have appeared, and the hind legs are only one-half of an inch in length, the tadpole measures five inches from the nose to the tip of the tail.

The bullfrog is a voracious eater, his prey embracing mammals, birds, reptiles, batrachians, insects, crustaceans, and mollusks. In the stomach of one shot in New Jersey, I found one meadow mouse (*Arvicola riparius*), two May beetles (*Lachnosterna quercina*), one ground spider (*Dysdera*), one potato bug, and one water beetle of the family Hydrophilidæ. In another one from Maryland, caught in June, I found two large black scarabæan beetles (*Copris carolina*), ten May beetles, and one leaf hopper (*Tetigonia*). I have known it to devour crawfish (*Astacus bartoni*), little turtles, and snails of different species; and have heard from authentic sources that it swallows young ducks when there is an opportunity. A friend caught one near Trenton, N. J., which contained a young domestic duck. One which I placed with five full-grown frogs (*Rana clamitans*) took compassion upon them in their captivity, and swallowed four of them in as many nights. I have frequently found large stones in the stomachs of these frogs. It is not probable they were swallowed for the purpose of assisting digestion, but rather by accident.

A frog of the *Halecina* species, which I had in captivity for over two years, at length became unable to eat, and died. I found a large pebble wedged in the posterior part of its stomach, which no doubt caused its death.

The manner of hunting the bullfrog is either by shooting or catching them with a hook baited with a piece of red or bright colored flannel or a real or artificial insect. When the frog is observed, it must be quietly approached, and the bait dangled in front of it, when it will spring up, seize the bait, and hook itself, no doubt mistaking the flannel for a butterfly or moth.

Frog legs are presented for sale in Philadelphia game markets arranged in dozens, one dozen pairs being impaled in a series upon a stick. They are, of course, all sold for bullfrogs, but the far greater number I ever saw thus exposed for sale were the common ditch frogs (*Rana clamitans*). They may be as palatable as their larger cousins, but there is very little meat about them.



THE BULLFROG. (*Rana catesbiana*, Shaw.)

This frog is known by its deep, bellowing note. It can be heard on almost any summer evening where they are numerous, but most generally in early spring. The nearest approach to this note that can be represented by letters is "gurr-r-r-roun, gurr-r-r-roun!" with the accent on the last syllable, uttered in a deep, rolling, guttural manner. On account of their note they are called "bloody nouns" in portions of the South.

The length of the head and body, in full-grown Pennsylvanian specimens, is from six to ten inches; of the hind legs, eight to twelve inches. In the South they often grow much larger, Holbrook says, reaching even twenty-one inches. It is found from Canada south to Florida and Texas, and west to Missouri.

THE value of the exports of mineral oils for 1885 was $49,671,743, against $49,457,116 the year before. Imports for 1885, $13,812; 1884, $25,513.

OLD ORGANS AND PIANOFORTES.

One of the most remarkable features of the late Inventions Exhibition certainly consisted in the exceedingly interesting loan collection of old and historic musical instruments. These were exhibited in the Albert Hall gallery, under the direction of Mr. A. J. Hipkins, whose intimate and practical knowledge of the subject proved of the greatest value, especially in the classification and arrangement of the several kinds of instruments and musical rarities exhibited. The various sketches which we herewith publish illustrate some of the old organs and pianofortes which were included in the collection, and belonging to the Brussels Conservatoire, by whom we were favored with special permission to make studies for our pages.

The history of the organ commences at the earliest times, and it is certain that the germ of the most important parts of the instrument, even as we now know it, had been discovered long before the beginning of the Christian era. Moses, in the 4th chapter of Genesis, speaks of Jubal "the father of all such as handle the harp and the organ (*ougab*)." This instrument, also called "pipe," "reed," and "syrinx," was doubtless nothing more than a series of reeds or tubes bound together, of varied sizes and of graduated lengths, like the ordinary "mouth organ" of the present day, and known from the myth of Pan as "Pan's pipes," or termed Pandean pipes, as shown by Fig. 1. The syrinx was played by Greek and Roman herdsmen in the performance of their simple melodies. Afterward it was discovered that by cutting openings in the length of the pipes at certain intervals, more than one sound could be produced by a single tube, and subsequently from this rude model was developed the "Flute-a-bec." The penny tin whistle of modern times is a reminiscence of the primitive "squeaker" here referred to. The next development, based on the same principle as the ancient "bag pipe," was the addition of the wind chest or box, into which the lower ends of the reeds were fixed. Flexible tubes were employed with which to charge this chamber, and frequently two persons were employed to blow alternately in order to keep up a continuous blast, the player using his fingers so as to moderate the voice of the instrument, and prevent all the pipes from speaking simultaneously.

Fig. 2, reproduced from Father Kircher's "Musurgia" (a folio dated 1650), illustrates the most important improvement of the organ upon that last described, and which will be found depicted on a sculptured monument in the museum at Arles, dated XX.M.VIII. Kircher's drawing shows an organ blown by the

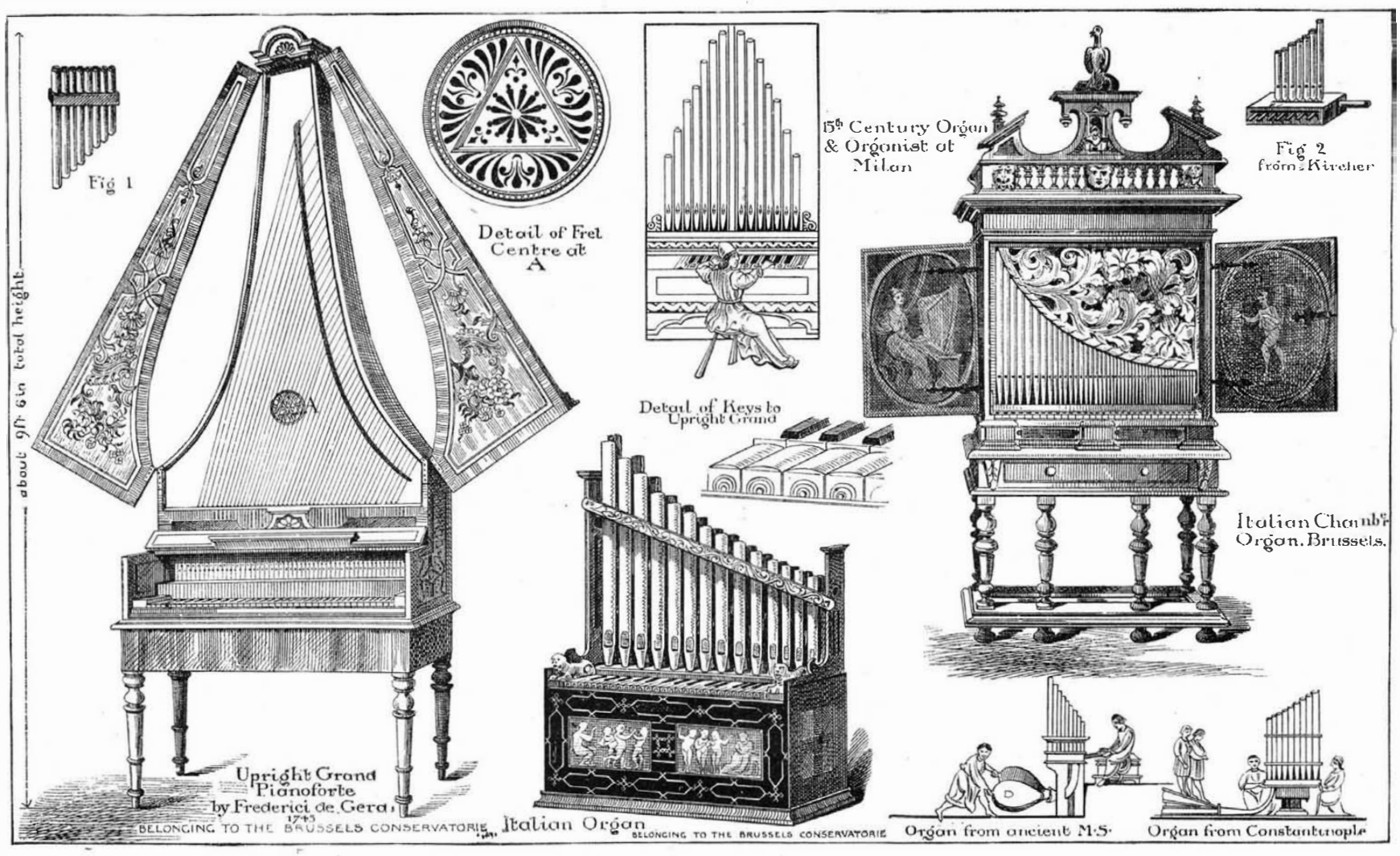


Fig 1
about 9ft 6in total height
Detail of Fret Centre at A
15th Century Organ & Organist at Milan
Fig 2 from Kircher
Detail of Keys to Upright Grand
Italian Chamb. Organ. Brussels.
Upright Grand Pianoforte by Frederici de Gera 1745
BELONGING TO THE BRUSSELS CONSERVATORIE
Italian Organ
BELONGING TO THE BRUSSELS CONSERVATORIE
Organ from ancient M.S.
Organ from Constantinople

OLD ORGANS AND PIANOFORTES.—SKETCHED BY MAURICE B. ADAMS.

© 1886 SCIENTIFIC AMERICAN, INC

mouth, with sliders or perforated slips of wood arranged under the inlets to the pipes in such a way as to shut off the air as desired by drawing the slips or sliders in and out from the front, as here delineated in Fig. 2. This contrivance furnished really the origin of the modern valve, and was unquestionably a great step toward the perfecting of the instrument. The Hebrew "Magrephah," also shown by Kircher, had two bellows attached at the rear of the wind box and worked from behind (the antitype of our modern harmonium), by which means a fairly uniform current of air was obtained. The magrephah had ten notes, with ten pipes to each note, and it is spoken of as having stood in the Temple of Jerusalem.

In the Talmud the hydraulic organ is mentioned under the name of "hidraulis" or "ardablis," and several references could be added did space allow to show that windmill organs and hydraulic organs were well known as early as the 3d century. A 4th century organ is thus described by a Greek epigram, attributed to the Emperor Julian the Apostate, who died A.D. 363, in the following literal translation:

"I see a strange sort of reeds—they must, methinks, have sprung from no earthly but a brazen soil. Wild are they, nor does the breath of man stir them, but a blast leaping forth from a cavern of ox hide, passes within beneath the roots of the polished reeds; while a lordly man, the fingers of whose hands are nimble, stands and touches here and there the concordant stops of the pipes; and the stops, as they lightly rise and fall, force out the melody."

Theodosius, who died A.D. 395, erected an obelisk at Constantinople which has a sculptured representation upon it of an organ of great interest, and which we have here redrawn, because it illustrates a singular mode of giving weight to the bellows by men standing upon them, a method which was not unfrequently followed more than a thousand years later, as, for instance, at the old church of St. Ægidien, in Brunswick, which Prætorius illustrated in 1620, showing 20 bellows worked by ten men, each bellows having a wooden shoe upon it, the blowers holding a transverse bar and treading with their feet after the style of a treadmill. Julianus, a bishop of Spain in A.D. 450, says that organs were in common use in the churches of that country during his time, and in A.D. 666 Pope Vitalian introduced the organ into the services of the congregations, appointing also canonical singers. The Anglo-Saxons were acquainted, too, with its use, and as far back as the commencement of the 8th century the instrument was made and thoroughly appreciated in England.

Aldhelm, who died A.D. 709, tells us that organs at that time were ornamented with gilding. In the 9th century they became common in England, and English makers constructed their instruments with pipes of copper fitted in gilt frames. At Malmesbury Abbey, between the years 925–988, St. Dunstan erected an organ with pipes of brass, and gave another similar one to Abingdon Abbey, besides those provided by him in several other English churches.

Elwin gave an organ to Ramsey with copper pipes "and a far-resounding peal." The MS. Psalter of Edwin at Trinity College, Cambridge, furnishes an early instance of the instrument as it was then known. In the British Museum, in a Saxon MS. of the 11th century is a drawing of the "Bumbulum cum fistula aerea," with brass pipes, but having no keyboard. The "Bumbulum" in this respect is like that described by Monk Theophilus in his "Divers Arts," which was written in the early part of the same century. We here draw from "Thesaurus Diptychorum," by Gori, dated 1759, a copy which is there preserved of a MS. drawing of an old organ, said to be contemporary with Charlemagne. It shows a pneumatic organ, blown by two bellows, and, like the Theophilus one, played by sliders from the front. King David, in the original MS., is playing the harp or lyre, and singing psalms, while beside the organ he is accompanied by a trumpet, a sort of violin, and a set of bells. Wulstan, the monk of Winchester, describes the great organ set up in that cathedral by order of Bishop Elphege, who died in 951, and Wackerbarth, in his "Music of the Anglo-Saxons," gives a full translation of the monk's poem descriptive of it.*

The first keyboard was employed at Madgeburg, at the close of the eleventh century. This organ had 16 keys, which were an ell long and 3 inches broad, as will be seen figured in Prætorius' "Theatrum Instrumentorum seu Sciagraphia," Wolfenbuttel, 1620. Harmony was then unknown, and plain chant did not require more than 9 to 11 keys, which was nearly their greatest extent. The spring box soon followed the introduction of keys, which at first were several inches wide, and were played on like carillons, as in Belgium, France, and Holland, by striking them with a sharp blow of the fist—"Clarions loud Knellis Portatives ad bellis."†

Dom Bedos mentions some of these early organs as having keys 5 inches or 6 inches wide, whence, according to Scidel, arose the expression "organ beater."

* See Dictionary of Music and Musicians, by Sir George Grove, p. 578.
† Poem of the "Houlate," 1450.

From Franchinus Gaffurius' "Theorica Musica," printed at Milan in 1492, we reproduce an engraving showing an organist performing on an instrument with broad keys, which is very interesting; and it also shows long and short keys combined on one manual. Besides this, as Hopkins points out in his work on "The Organ," "the peculiar interest of the drawing represents the player using both hands independently of each other; the melody—possibly a plain song—being taken with the right hand, which appears to be proceeding sedately enough, while the left seems to be occupied in the prosecution of a contrapuntal figure." Regals or Portative organs, from the Italian "Rigabello," were used to give out the melody of plain song. A representation of a very early instrument of this kind figures in Lucinius' "Musurgia" (printed at Strassburg, 1536), and showing bellows fixed in the rear part, worked like that which M. Paul de la Roche has painted in his fine picture of Ste. Cecile, illustrated by us to-day from Forster's splendid engraving. One angel holds the instrument while the other blows the bellows as the Saint chants and plays upon the keys. The little Italian organ which we have sketched from the Brussels Conservatoire is another somewhat similar example. It is beautifully inlaid with ivory, and is richly engraved with figure sculpture. The use of "Portatives" or "Regals" seems to have been almost universal, and frequent mention of them is made by old poets, as, for example, Gavin Douglas says:

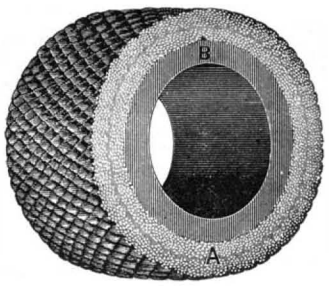
"On crowd lute, harpe, with monie gudlie spring,
Schalmes, clariouns, *portatives* heard I ring."

At St. John's Church, Cirencester, and in the crosier of William of Wykeham at New College, Oxford, Regals are represented, showing the usual form then in use. The Italian chamber organ, drawn next to the last named specimen, is a curious and singularly pretty little instrument with painted doors, which open on rude cross-garnet hinges, discovering inside a boldly carved and foliated front, which is gilded with various golds in high effect. The body is black, relieved by natural colored woods for the mouldings and the legs. A drawer occupies a central place below the keyboard, and the lower part would make the instrument very difficult to sit at. It is, strictly speaking, a "box of whistles," as Sir Christopher Wren called Father Smith's organ at St. Paul's Cathedral.

Our last drawing represents by no means the least interesting subject of our various sketches. It shows an "upright grand piano." The instrument was made by Frederici de Gera in 1745, and it now belongs to the Brussels Conservatoire. The doors are nicely enriched with inlay veneer, and the center of the soundboard within the case is ornamented with a charmingly fret-cut rose, a detail of which figures by the side of the general view of the instrument. The total height of the piano is about 9 feet 6 inches. The keys are rounded, as shown by the detail sketch, reminding one of the manuals to the old organ in the church of St. Ægidien, in Brunswick, previously referred to, and which were, perhaps, the very first to foreshadow the modern keyboard, not only of our organs, but of our pianos also.—*Building News.*

COWEN STEAM HOSE.

An entirely new departure in steam hose is shown in the accompanying cut. The novelty lies in its being made with cotton jackets outside to hold a rubber tube within. It depends for its strength to resist a bursting pressure upon the cotton jackets, A, which are woven with heavy filling threads running spirally the whole length of the hose. Thus it gets as great strength as marline-wound rubber hose, at less cost. The strength of rubber hose depends upon the adhesive power of the rubber between the different layers of duck, and after steam has run through it a short time the rubber between the plies begins to soften and give way. Then the hose swells or blisters and soon bursts. It is claimed that the "Cowen" hose cannot burst from this cause.



The "Cowen" hose has a lining, B, which is cured just enough to stick to the fabric strongly, and is thoroughly cured by the passing of the steam when in use. It thus has a much longer life than the ordinary steam hose, for when it gets cured to the point where the rubber hose is before being used, it will then have lasted as long as the ordinary rubber steam hose.

It is impossible to put such a tube into rubber hose, for you must cure the tube and the friction between the duck at the same time; and if the tube is undercured, the friction will be also, and so will have no strength whatever.

It is especially adapted for rock drills and dredging machines, and will stand at least double the water pressure of ordinary hose, and has been tested on a dredging machine for over three months where a hundred pounds steam pressure is used.

It is used by many of the contractors on the new Croton Aqueduct, and is guaranteed to stand a steam pressure of 50 pounds three months.

The Boston Woven Hose Co., of 234 Devonshire St., Boston, are the sole owners and manufacturers.

The Telephone Caveat of Antonio Meucci.

As a matter of curiosity, we give below the caveat of Antonio Meucci, the Italian who claims to have been the original inventor of the telephone. This caveat was filed December 28, 1871; renewed December 9, 1872; renewed December 15, 1873.

The following is a description of the invention, sufficiently in detail for the purposes of this caveat:

I employ the well-known conducting effect of continuous metallic conductors as a medium for sound, and increase the effect by electrically insulating both the conductor and the parties who are communicating. It forms a speaking telegraph without the necessity for any hollow tube. I claim that a portion or the whole of the effect may be also realized by a corresponding arrangement with a metallic tube.

I believe that some metals will serve better than others, but propose to try all kinds of metals.

The system on which I propose to operate, and calculate for, consists in isolating two persons separated at considerable distances from each other by placing them upon glass insulators, employing glass, for example, at the feet of the chair or bench on which each sits, and putting them in communication by means of a telegraph wire. I believe it preferable to have the wire of a larger area than that ordinarily employed in the electric telegraph, but will experiment on this. Each of these persons holds to his mouth an instrument analogous to a speaking trumpet, in which the word may be easily pronounced and the sound concentrated upon the wire. Another instrument is also applied to the ears, in order to receive the voice of the opposite party.

All these, to wit, the mouth utensil and the ear instrument, communicate to the wire at a short distance from the persons. The ear utensils being of a convex form, like a clock glass, inclose the whole exterior part of the ear, and make it easy and comfortable for the operator. The object is to bring distinctly to the hearing the words of the person at the opposite end of the telegraph.

To call attention, the party at the other end of the line may be warned by an electric telegraph signal or a series of them. The apparatus for this purpose and the skill in operating it need be much less than for the ordinary telegraphing.

When my sound telegraph is in operation, the parties should remain alone in their respective rooms, and every practicable precaution should be taken to have the surroundings perfectly quiet.

The closed mouth utensil, or trumpet, and the inclosing the persons also in a room alone, both tend to prevent undue publicity to the communication. I think it will be easy by these means to prevent the communication being understood by any but the proper persons.

It may be found practicable to work with the person sending the messages insulated and with the person receiving it in free electrical communication with the ground, or these conditions may possibly be reversed, and still operate with some success. Both the conductors or utensils for mouth and ears should be—in fact, I may say, must be—metallic, and be so conditioned as to be good conductors of electricity.

I claim as my invention, and desire to have considered as such for all the purposes of this caveat—

The new invention herein set forth in all its details, combinations, and sub-combinations.

And more specifically, I claim—

First.—A continuous sound conductor electrically insulated.

Second.—The same adapted for telegraphing by sound or for conversation between distant parties electrically insulated.

Third.—The employment of a sound conductor which is also an electrical conductor, as a means of communication by sound between distant points.

Fourth.—The same in combination with provisions for electrically insulating the sending and receiving parties.

Fifth.—The mouth piece or speaking utensil in combination with an electrically insulating conductor.

Sixth.—The ear utensils or receiving vessels adapted to apply upon the ears in combination with an electrically insulating sound conductor.

Seventh.—The entire system comprising the electrical and sound conductor insulated and furnished with a mouth piece and ear pieces at each end, adapted to serve as specified.

In testimony whereof, I have hereunto set my name in presence of two subscribing witnesses.

ANTONIO MEUCCI.

Witnesses:
SHIRLEY MCANDREW.
FRED'K HARPER.

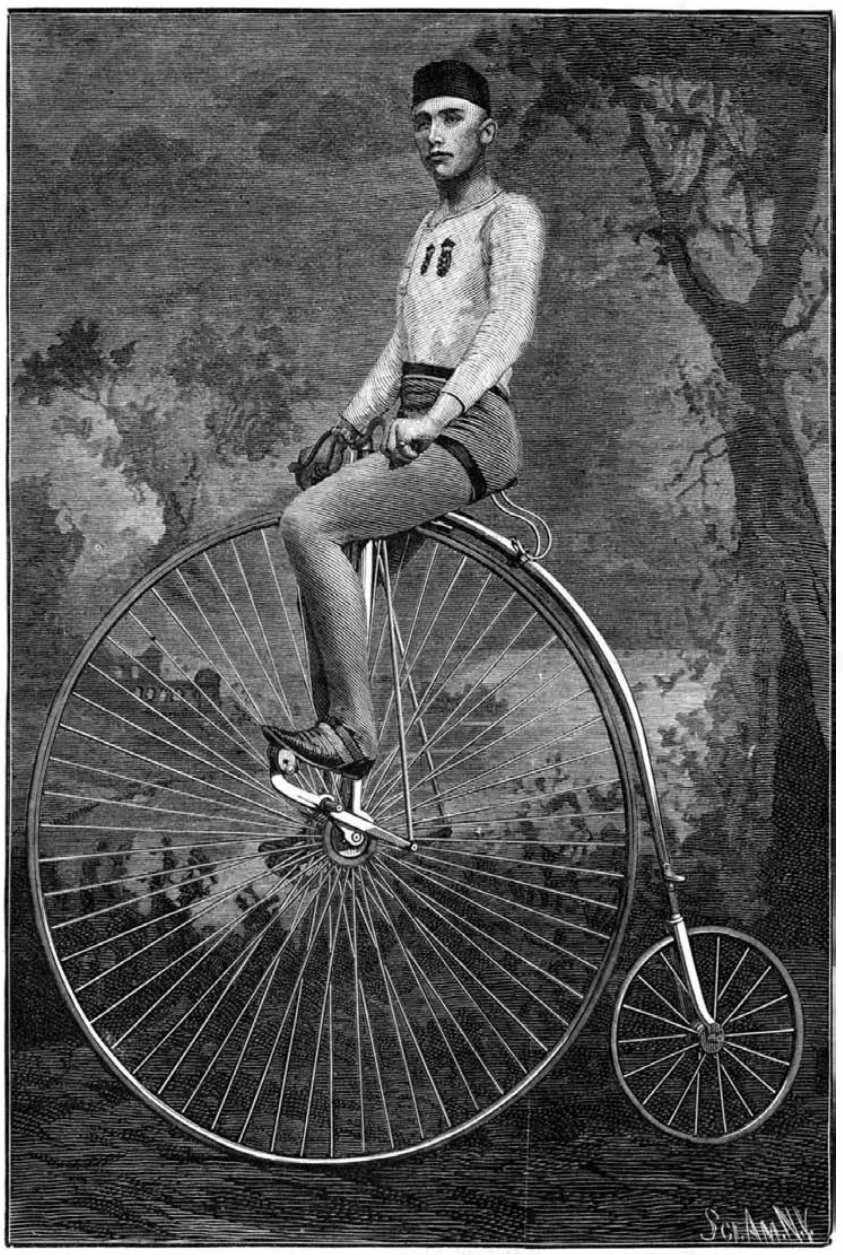
© 1886 SCIENTIFIC AMERICAN, INC

IMPROVED TREADLE FOR BICYCLES.

A novel and important improvement in treadles for bicycles and other pedomotive carriages, foot-propelled machinery, etc., is clearly shown in the accompanying engraving. The improvement consists of a short lever attached to the usual pedal pin extending several inches rearward, where it is hinged to a swinging fulcrum rod, which is hinged to the upper part of the fork, thereby allowing the lever to follow the crank motion with almost absolute freedom from friction, while at the same time it acts as a fulcrum for the lever, which, with the pedal, projects forward of the crank far enough to give a considerable advantage in leverage over the ordinary crank. The advantages of this construction are that, while adding but two pounds to the weight of the machine, it gives the rider more power in driving his wheel, and at the same time it shortens the foot motion several inches, giving a long, full down-stroke, which passes the dead center, with a comparatively short up-stroke. The crankpin can also be used as a pedal, giving a still shorter motion for down hill and easy grades, thereby avoiding the monotony of the continuous long motion of the ordinary crank. Another important feature is that by simply lowering the fulcrum rod, which can be done in two minutes, a small man can ride as large a wheel as he can climb upon.

It will be seen that the lever is so connected that at the point in the revolution where the crank possesses the greatest power, the fulcrum, axle, and crankpin are in the same line, which is at right angles, or nearly so, to the direction of the pressure, thus giving greater power than the simple crank would. Owing to the angle which the lever makes with the line of the dead centers when above and below it, that portion of the path of the crankpin during which the power is applied is greater than one-half, and the return portion, during which no work can be done, is correspondingly less; so that with two opposite cranks the working portions of the revolutions respectively overlap each other, and the dead centers are practically eliminated. By varying the relative proportions of the two ends of the lever, and the corresponding crank according to the purpose for which the machine is required, it can be adapted to obtain either increased speed, as in racing, or an increased power, as in hill climbing. According to the testimony of expert riders, these treadles are far superior to the ordinary crank, both as to speed and power. If necessary, ball bearings can be placed upon the crankpin, thereby reducing the friction to the minimum.

This treadle is the invention of Mr. Geo. J. Taylor, of Salt Lake City, Utah, who may be addressed for further particulars.



TAYLOR'S IMPROVED TREADLE FOR BICYCLES.

Waterproofing Paper.

A new composition for waterproofing paper consists of the following ingredients, combined in the proportions stated, viz.: resin, 50 per cent; paraffine, 45 per cent; silicate of soda, 5 per cent. These ingredients are thoroughly mingled by heating them together, and by agitation.

The paper to which the composition is applied is usually building or sheathing paper. The latter is taken in the condition in which it comes from the paper machine, being quite dry. A strip or strips of the paper, from a roll or other convenient holder, are conducted and drawn through the tank of hot composition, whereby the paper becomes well saturated with it, and upon emerging from the tank the paper passes between suitable rolls, which press any surplus composition from it, leaving it hard and smooth.

Sometimes the proportions of resin and of paraffine are varied from 5 to 15 per cent from those stated, retaining about 5 per cent of silicate of soda. Thus the proportions of resin and paraffine may vary between 50 and 65 per cent of the former, and between 45 and 30 of the latter, making a composition by which the paper is rendered waterproof and durable when exposed to the weather, and by means of which a surface finish both smooth and hard is obtained.

The Minutes Worth Saving.

The value of time is clearly demonstrated by Dr. S. A. Allibone, in his "Dictionary of Authors," when he shows by a time table (taking days in a year 313, and working hours in a day 8) that 5 minutes lost each day is, in a year, 3 days 2 hours 5 minutes; 10 minutes is 6 days 4 hours 10 minutes; 20 minutes is 13 days and 20 minutes; 30 minutes is 19 days 4 hours 30 minutes; 60 minutes is 39 days 1 hour.

Guns Worked by Steam, Gas, and Compressed Air.

In Richardson and Watts' "Chemical Technology," we find the following:

"High pressure steam is exceedingly well adapted to the performance of this kind of work; unluckily, it would require high pressure steam of 400 atmospheres, or 5,000 pounds pressure on the round inch, to perform this duty, and as such steam could only be generated in a furnace intensely heated, it is scarcely probable that boilers will be found sufficiently strong and durable to work continuously under such pressure. If they were found to be practicable, nothing more would be necessary than to bring a steam pipe from the boiler to the breech of every gun in a fortress or a ship, and the admission of the charge of such steam into the chamber by a valve would be sufficient to discharge the missile of the 68-pounder with a speed of 1,600 feet a second.

"The well-known Mr. Perkins studied this subject carefully, but applied it somewhat differently. He found that steam of this pressure could be generated only by water nearly red hot; and instead of throwing the steam into the breech by a pipe, he threw the red hot water into the breech of his gun, allowing it when there to expand itself into steam and expend its force in giving speed to the ball.

"This expedient of Perkins is well worthy of study. It has both the defects and advantages of a gunpowder gun. The red hot water thrown into the barrel would have the fault of being too powerful at the beginning of its expansion and too weak at the end. The barrel would be filled partly with water and partly with steam; and as the water grew into steam it would lower its temperature and its pressure, so that the explosive force would fall off very much toward the end of the stroke. This is the inevitable evil of allowing the water to become vapor in the gun. When the steam is generated in a separate boiler, and freely admitted into the breech of the gun, there is reservoir enough of heat and steam to maintain the even pressure in following up the ball from the breech to the muzzle. It is the evil of charges converted into gas within the breech of the gun that their temperature and pressure are too high at starting and too low at the end. The steam gun would in this respect be the best of our projectile forces.

"Compressed air has many of the advantages and some of the defects of steam; and the frequent use of the air gun has shown its convenience as well as its efficiency. Air can be compressed into a reservoir by mechanical force, just as steam can be raised in a boiler by heat; and by compressing 400 times the natural quantity of air into a given space, a pressure of 400 atmospheres might possibly be obtained in this way. If an air pipe communicated from this reservoir to the breech of our gun, air of 400 atmospheres pressure would certainly be able to follow up the 68-pounder shot, with pressure and velocity able to discharge it with a speed of 1,600 feet per second, and, therefore, to do our work; but the apparatus would be full of mechanical difficulties.

"Liquid gases are known to be receptacles of enormous mechanical power. Carbonic acid gas, liquefied and shut up in a reservoir, generates large volumes of gas with great rapidity the moment it is permitted to expand. Other gases expand with still greater rapidity and force; and if we could conceive liquid gases to be easily made, safely carried, and comfortably handled, a charge of liquid gas bottled up in the breech of a gun would be a very effectual propelling power, and quite able to generate the force we want, and to apply it within the time we require. This system, however, is also beset with mechanical difficulties.

"The preceding illustrations of steam, compressed air, and liquid gases lead us on very instructively to the manner in which fire has become necessary to do the work of a gun. A supply of heat is essential to the expansion of a gas, and a rapid supply is indispensable to the rapid performance of the work. In steam, the fire is not only external to the gun, but external to the boiler in which the steam is generated. In gunpowder, the fire is introduced into the inside of the gun, for the purpose of supplying the heat that is wanted to raise the gases to their elastic pressure, and to maintain them at that pressure while expanding. Red hot steam introduced into the breech of a gun rapidly cools down and loses its heat and power in expanding.

"If we could introduce fire into the breech of the gun at the same time, to maintain the heat of the steam and the water, the steam would become an admirable propelling force. Carbonic acid gas, expanding rapidly from the liquid into the gaseous state, cools down so suddenly as not only to lose its mechanical power, but to freeze into solid flakes of snow. If we could charge the breech of the gun with fire as well as with liquid gas, the fire would give it the heat it wants, prevent its congelation, and maintain its power to the end of the discharge.

"What gunpowder and guncotton do is really to provide a reservoir of gas and a fire to heat it simultaneously, and in the same chamber. In the case of gunpowder, the fire is fed with charcoal; in the case of guncotton, the fire is fed with guncotton wool—another form of carbon. In gunpowder, large quantities of carbonic acid gas are generated, possibly in the liquid state, and are heated by the internal furnace of the charge, possibly red hot. In like manner, in a guncotton charge, red hot water or steam is introduced with other gases, possibly also liquids, together with an internal furnace of flame; and thus the work is done—first, by the release of the gases themselves, and, secondly, by the continuance of the elasticity of those gases by the internal supply of heat. This is how gunpowder and guncotton really do the work of a steam gun, a carbonic acid gun, or any other kind of gas gun."

The Electrolytic Cartridge for Blasting.

The cartridge consists of a glass tube of a diameter to fit easily into the borehole, which should be small. The tube is very strong, the thickness of its walls being about equal to the diameter of the bore. Two wires are fused into this tube, which is hermetically closed after being nearly filled with water rendered conductive with a little acid or some metallic salt. When this cartridge has been inserted into the borehole, and the latter tamped or stemmed in the usual way, its projecting wires are connected with cables serving as "leads" from a source of electricity. All being ready, the current is put on, and the current from the generator passes between the ends of the wires within the glass tube, and decomposes the water, oxygen being liberated at one pole and hydrogen at the other. This explosive mixture continues to accumulate as the decomposing action of the current goes on. It is to withstand the increasing pressure of these gases that the thick glass is required. So long as the ends of the wires are covered by the liquid, no spark can be produced to ignite the gaseous mixture; but when these—or one of them—are laid bare by the conversion of the water into gas, the current has to pass through the latter, which is then fired. The resulting explosion is extremely violent—more violent than that of nitroglycerine even.

© 1886 SCIENTIFIC AMERICAN, INC

ENGINEERING INVENTIONS.

A rotary engine has been patented by Mr. John W. Emerson, of Opoka, Fla. It has a driving wheel with a central passage, and curved passages radiating therefrom to and through the periphery of the wheel, to receive and discharge the steam or other driving fluid admitted under pressure through a hollow shaft of the wheel from a supply pipe.

An automatic railway gate has been patented by Mr. James K. Patterson, of Crete, Neb. It has main bars pivoted to a side post, and pickets hinged to the bars, so that as the gate is lifted vertically by the weight of an approaching train, the pickets will hang down somewhat as a fan closes, and after the train has passed the gate will come down in place mainly by its own gravity.

AGRICULTURAL INVENTIONS.

A corn planter has been patented by Mr. John A. Cherry, of Roads, Mo. By this device the corn is clucked by knife blades mounted on a revolving axle, which mark the ground at every hill of corn deposited, and the weight of the driver is utilized to effect the desired pressure on the runners and wheels for working the marking knives.

A seed planter has been patented by Messrs. James A. Roden and Nicholas C. Morgan, of Deerbrook, Miss. It is more especially intended for planting cotton seed, and provides means whereby the seed discharged at one time can be regulated, the soil packed upon the seed and the top of the row rounded and the plows adjusted to work at any desired depth or be supported above the ground.

MISCELLANEOUS INVENTIONS.

A revolving sign has been patented by Mr. John F. Bengert, of Brooklyn, N. Y. This invention covers a manner of constructing signs in such way that they will be revolved by the wind, and thus attract attention, the construction being simple, and signs so put up not liable to get out of order.

A lathe chuck has been patented by Mr. Edward Pement, of Esmond, Dakota Ter. This invention relates to improvements on a recently patented improvement of the same inventor, and provides a simplified construction, intended also to render the chuck more effective.

A blind slat adjuster has been patented by Mr. Peter Rundquist, of New York city. The slats have end recesses, and cranks with side lugs on their stems engage with these recessed ends to turn the slats, while the slats can thereby be readily adjusted to any desired angle.

A cabinet for tobacco, cigars, etc., has been patented by Mr. Charles N. Swift, of New York city. It has a water receptacle and novel construction of capillary conductors, whereby the air throughout the interior of the cabinet may be kept at uniform humidity, and the degree of moisture may be readily regulated.

A ticket case has been patented by Mr. William M. Stevenson, of Adelaide, South Australia. Combined with a containing case and its inclosed spring pressed follower is a sliding cap with slots to receive lugs on the follower, whereby tickets may be forced out of the case one at a time as desired.

A vegetable grater has been patented by Mr. Peter Blum, of Orrville, Mo. It is made in cylindrical form, of sheet metal, punched to form the cutting points, and attached at one end to a circular head, the opposite end being open, through which the grated material is discharged, the cylinder being revolved by a crank.

An embroidering machine has been patented by Fridolin Schnelle, of West Hoboken, N. J. This invention relates to improvements on the Heilman or Swiss embroidery machine, with special reference to those designed for embroidering handkerchiefs, and relating particularly to the construction of the immediate attaching frame carried by the tambour frame.

A draught equalizer has been patented by Mr. Joseph M. Langston, of Berlin, Ill. It is a device adapted for use with four horse teams, and so constructed that with its use an equal amount of the load will be drawn by each animal, the invention being an improvement on a former patented invention of the same inventor.

A swimming apparatus has been patented by Mr. William J. Corbett, of Tucson, Arizona Ter. To the under side of a plate made to conform to the bottom of the foot is pivoted a blade frame carrying a novel construction of feathering web, giving a broad surface for the stroke, which surface is diminished on the return movement of the leg.

A clamp for stopping leaks and bursts in pipes has been patented by Mr. William W. Knight, of Jersey City, N. J. It has a side opening and interior recesses at the opposite sides, with a pad of leather, copper, or other suitable material, concaved saddle, and key, whereby the pad and saddle can be readily forced down upon a pipe and held in place.

A water elevator has been patented by Mr. Robert C. Dugan, of Millersburg, O. This invention covers special devices for lifting water by a windlass from wells, in connection with a carrier, with pulleys, by which the water may be carried horizontally to a distance and delivered in a spout or as otherwise desired.

A mechanical movement has been patented by Mr. Frederick Reed, of Solomon City, Kansas. This invention covers a novel arrangement and combination of parts by means of which motion can be transmitted from one crank to another, or from a reciprocating bar to a rotating crank, or from a crank to a reciprocating bar, avoiding dead centers.

A fetter for cows' tails has been patented by Mr. Benjamin S. Slinn, of Spring Valley, N. Y. It consists of an anti-switching attachment, made with a rod having spring clamps, whereby the attachment can be readily applied to and detached from a cow's tail, to prevent the cow from switching her tail in the milker's face.

A safety attachment for watch pockets and similar uses has been patented by Mr. John H. Barnes, of Greencastle, Ind. It has a plate to be secured to the pocket with a chain-supporting hook and a lock, with a watch-securing device, whereby the watch may be made fast and the chain passed up over the hook, so that any strain only binds the watch more firmly.

A mail bag catcher has been patented by Messrs. Ethan Allen and William H. Harrod, of Sellersburg, Ind. It is attached to a crane or post at the side of the tracks, and so made that at the same time a pouch is taken from the crane by the gripper on the car a pouch is taken from the car by the gripper on the crane, a bar being reversible to catch pouches on trains running in either direction.

A gas pressure regulator has been patented by Mr. Robert F. Hatfield, of New York city. Combined with the inlet pipe and regulator having valve apparatus operated by the gas pressure is a float and attached valve operated by the rise and fall of the liquid constructed in such manner that the float valve and the regulator valve shall be independent of each other.

A telegraph sounder has been patented by Mr. Alphonso S. Keating, of Corry, Pa. The invention consists of a novel combination with a magnet coil of a pivoted armature in which a diaphragm is held, to be used as a telephone when the telegraph signals cannot be understood readily, or as a telegraph instrument when the telephonic communications are rendered indistinct by induction.

A soldering iron has been patented by Mr. Henry M. Dixon, of New York city. The larger or tip end is countersunk, with an oblique perforation, in which is removably fitted a copper tip, that may be replaced by another of different shape, according to the work required, the construction being such as to give the greatest amount of metal to retain the heat at the working end of the stock.

A machine for sawing hoop poles has been patented by Mr. Edwin Powell, of Williamsport, Pa. This invention provides a machine with which the hoop may rest flat at the point of sawing, whether the pole be bent or straight, so that crooked poles may be cut with greater facility, and the gauge is simple, held rigidly at right angles to the saw, and moving freely therefrom in the arc of a circle.

A watchmaker's screw driver has been patented by Mr. Oliver L. Neal, of Waltham, Mass. It is also adapted for holding and working a drill, and has a flexible thumb and finger pieces to allow them to be bent according to the hand of the operator, in working a miniature pinion wheel and rack bar, whereby a screw can be turned in or out at one movement or a drill rapidly rotated.

A combination folding bed has been patented by Mr. Abraham T. McCurry, of Goodland, Ind. It is adapted for construction with a bookcase or other upright article of furniture, having an apartment at the top for bed clothing, the bedstead being attached by plates to corner irons in the case, which irons constitute two of the legs of the bedstead when it is lowered to a horizontal position.

A bark cutting machine has been patented by Mr. John C. Hagerty, of Santa Cruz, Cal. It has a rotating wheel within a suitable casing, the wheel being provided with knives, which cut off the ends of the bark as the latter is fed down a chute, the cut off ends of the bark being carried inward toward the hub of the wheel and then inward ejected to fall downward through an opening in the bottom of the casing.

An apparatus for dyeing has been patented by Messrs, John O'Connell and Frank E. Weeden, of Providence, R. I. Combined with operating and supply tanks and a force pump is a system of pipes, and other novel features, intended to dye, wash, under pressure and a continual stream of either liquor, air, or gas, wool in the fleece, card balls, roving and yarn, in hank or in spools, as well as cotton, flax, and jute, and other fibrous or woven materials.

A pump has been patented by Mr. Hiram M. D. L. Babcox, of San Francisco, Cal. The air chamber has an open lower end combined with the plunger, the upper enlarged end of the pump case, and an enlarged upper air chamber with a lower open end, and the combination with these parts of the working barrel with a surrounding water space, the invention being an improvement on a former patented invention of the same inventor.

A damper regulator has been patented by Messrs. Charles A. McDonald and Charles W. Townsend, of Portland, Oregon. This invention covers means whereby a positive action or direct pressure of the working vapor, gas, etc., is used to close the damper or valve, also means for providing for the escape of the vapor or gas after it has performed its work, and for draining the connections of fluid or condensed vapor. The same inventors have likewise patented a damper regulator for steam boilers on the same principles, but especially applicable to controlling the dampers in the ash pans of locomotive steam boilers.

A billiard cue tip fastener has been patented by Mr. Henry A. Harmer, of East Newark, N. J. This invention consists in the combination, with a cue tip, of two half screws or pins having prongs passed into the tip, the half pins or screws being secured in the end of the cue, and thus holding the tip on the end of the cue, or the fastening may thus be permanently made with glue. For State rights for this patent apply to J. Harmer, 236 Harrison Avenue, East Newark, N. J.

NEW BOOKS AND PUBLICATIONS.

THE PRACTICAL ESTIMATOR. By J. D. Sibley and A. O. Kittredge. New York: David Williams, 1885.

Furnishes in a compact form some very good hints upon how an estimate should be prepared, a complete list of the items to be considered, and a table of rules and formulæ for calculating quantities. With this assistance he can go to work at once, without puzzling himself as to whether anything has been forgotten.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

One Cent Invested

in a postal card on which to send your address to Hallett & Co., Portland, Maine, will, by return mail, bring you free full particulars about work that both sexes, of all ages, can do and live at home, earning thereby from $5 to $25 per day, and upward. Some have earned over $50 in a single day. Capital not required; you are started free.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

Metallic Pattern Letters and Figures to put on patterns of castings. H. W. Knight, Seneca Falls, N. Y.

The Beginning of Consumption.

Blotches, pimples, eruptions, "fever sores," ulcers, and enlarged glands are but so many *outward* manifestations of poisonous and scrofulous humors in the blood, which sooner or later are apt to attack the delicate tissues of the lungs, causing ulceration and consumption of these organs. Be wise in time and use Dr. Pierce's "Golden Medical Discovery," the greatest blood purifier, pectoral, and strength giver yet known to medical science. It cures all these dangerous maladies having their origin in the blood, if taken in time.

Tunneling Under the Hudson River. Giving full particulars of the prosecution of the work thus far. With working drawings, in 27 handsome plates, showing all details. By S. D. V. Burr. $2.50.

Catarrh, Catarrhal Deafness, and Hay Fever.

Sufferers are not generally aware that these diseases are contagious, or that they are due to the presence of living parasites in the lining membrane of the nose and eustachian tubes. Microscopic research, however, has proved this to be a fact, and the result is that a simple remedy has been formulated whereby catarrh, catarrhal deafness, and hay fever are cured in from one to three simple applications made at home. A pamphlet explaining this new treatment is sent free on receipt of stamp by A. H. Dixon & Son, 305 King Street West, Toronto, Canada.—*Christian Standard.*

Wm. Frech, Manufacturer of Sensitive Drills, Turret and Speed Lathes, Power Punching Presses, 68 W. Monroe St., Chicago.

Modern M'ch. Tools a specialty. Abbe Bolt Forgers, Power Hammers, Lathes, Planers, Drills, and Shapers. Send for estimates. Forsaith M. Co., Manchester, N. H.

To Manufacturers.—The owner of 260 acres of ground at Pittsburg, on the Allegheny River and Pennsylvania system of railroads, in order to improve the property, offers to donate a number of excellent manufacturing sites. See adv. of Whitney & Stephenson, this issue.

Order our elegant Keyless Locks for your fine doors. Circular free. Lexington Mfg. Co., Lexington, Ky.

Geo. E. Lloyd & Co., Electrotype and Stereotype Machinery, Folding Machines, etc., Send for catalogue. Chicago, Ill.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Grimshaw.—Steam Engine Catechism.—A series of thoroughly Practical Questions and Answers arranged so as to give to a Young Engineer just the information required to fit him for properly running an engine. By Robert Grimshaw. 18mo, cloth, $1.00. For sale by Munn & Co., 361 Broadway, N. Y.

Woodw'kg. Mch'y, Engines, and Boilers. Most complete stock in U. S. Prices to meet times. Send stamps for catalogues. Forsaith M. Co., Manchester, N. H.

Shafting, Couplings, Hangers, Pulleys. Edison Shafting Mfg. Co., 86 Goerck St., N.Y. Send for catalogue and prices.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

Air Compressors, Rock Drills. J. Clayton, 43 Dey st., N.Y.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Send for Monthly Machinery List to the George Place Machinery Company, 121 Chambers and 103 Reade Streets, New York.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Wood Working Machinery. Full line. Williamsport Machine Co., "Limited," 110 W. 3d St., Williamsport, Pa.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co, New Haven, Conn.

Curtis Pressure Regulator and Steam Trap. See p. 350.

Best Automatic Planer Knife Grinders. Pat. Face Plate Chuck Jaws. Am. Twist Drill Co., Meredith, N. H.

Bradley's improved Cushioned Helve Hammer. New design. Sizes, 25 to 500 lb. Bradley & Co., Syracuse, N. Y.

Cushman's Chucks can be found in stock in all large cities. Send for catalogue. Cushman Chuck Co., Hartford, Conn.

Cyclone Steam Flue Cleaners are the best. Crescent Mfg. Co., Cleveland, O.

Curtis Pressure Regulator for Steam Heating Apparatus, Waterworks, etc. Curtis Regulator Works, Boston, Mass.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 93.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 136 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Domestic Electricity. Describing all the recent inventions. Illustrated. Price, $3.00. E. & F. N. Spon, New York.

Friction Clutch Pulleys. D. Frisbie & Co., Phila.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

Pattern and Brand Letters, Steel Punch Letters. Vanderburgh, Welis & Co., 110 Fulton St., New York.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. W. asks: Will you please inform me, through the correspondence column of the SCIENTIFIC AMERICAN, of what the prisms of a Leclanche battery are composed? A. They are formed of granulated oxide of manganese, and a small percentage of cement material, such as shellac. 2. Is it necessary in all cases, in the construction of a dynamo machine or electric motor, to use a smaller gauge of wire on the armature than on the electro magnets, and if so, in what ratio is the difference generally made? A. The winding of the armature and field magnet of a dynamo electric machine depends altogether upon the use to which the machine is to be applied. It is not always necessary that the wire of the armature should be smaller than that of the field magnet. In Edison's large machines the winding of the armature consists of large copper bars, while the winding of the field magnets consists of wire very much smaller than the copper bars of the armature. 3. Is the carbon taken from gas retorts identical with that used in electric batteries. If so, how is it prepared? A. It is of the same character, but of better quality than is generally employed. Battery carbons are generally prepared from selected pieces of coke, pulverized and mixed with carbonizable cement, and afterward carbonized in a closed retort.

(2) E. M. D.—Oil barrels are painted with glue and any cheap color. Where large quantities are used, the color and glue, of the consistency of oil, is run through a paint mill. Chalk or whiting tempered with yellow ocher or indigo blue is the color generally used. It is not for sale mixed. The paint trade can furnish the materials.

(3) G. W. D. asks: Can vinegar be deodorized without impairing its efficacy? A. The odor of vinegar will be lessened by filtering the fluid through charcoal. Its strength will not be impaired by this process.

(4) A. C. J. asks: What is the best way to clean alabaster? A. Soap well, and wash with hot water. If stained, apply fuller's earth, pipe clay, or whiting for three or four hours, then wash off. If very dirty and stained, first wash with nitric acid diluted with water.

(5) W. B. asks for a formula for making flint glass. A. The following quantities form a very excellent glass:

Fine white sand	300 parts.
Red lead or litharge	200 "
Refined pearl ashes	80 "
Niter	20 "

Arsenic and manganese, a small quantity.

(6) R. C. B. writes: A bets B that there is only one pair of driving wheels on a locomotive. B bets A there are two pairs. Which is correct? A. All are driving wheels that are connected with the cylinders, directly or indirectly.

(7) W. R. C. writes: I am interested in building a small steamer. I have an engine 8 inches in diameter and 8 inches stroke. Cutting off steam at half stroke, what heating surface will I require to keep 100 pounds pressure running at 300 revolutions per minute? Also, can a single slide valve be used to cut off steam at half stroke advantageously? A. You will require 434 square feet of heating surface in your boiler. A single slide valve can be made to cut off at half stroke, economizing 86 per cent of the initial pressure, for which the lap should be arranged for the cut off at half stroke. We recommend you McCord's "Practical Treatise on Valve Gear," which we can furnish for $3.

(8) R. F. desires a good cement that will cement asbestos, one that does not contain grit. A. See the article on "Cements," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158. Ordinary glue would be all that is necessary if the asbestos is to be used with wood.

(9) W. A. O. asks for a simple method of testing coal oil. A. A simple petroleum tester is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 283.

© 1886 SCIENTIFIC AMERICAN, INC

The principle underlying petroleum examination is the determination of the temperature at which the oil takes fire or flashes. Heating a sample in a cup over a spirit lamp and applying a burning match or taper to the surface until the oil flashes, and noting the temperature, is the crudest plan that can be adopted. Good oil should flash only above 110 deg. F.

(10) C. J. H. writes: There are many houses in Leadville whose ceilings, in lieu of lath and plaster, are covered with canvas and calcimined. In many cases, leakages of water from the roofs or upper floors upon the canvas have caused fantastic stains to appear, which will not "out" by covering with calcimine. A. The calcimine has not sufficient body by itself to cover the stains. By mixing with it zinc white, the difficulty will be overcome.

(11) S. N. H. asks: 1. How to make an article known as aureoline, for bleaching the hair. A. The substance called aureoline is simply hydrogen peroxide perfumed. See description of its manufacture in SCIENTIFIC AMERICAN SUPPLEMENT, No. 184, also consult the article in No. 339. 2. The receipt for a liquid that is used to "show up" microscopes. It resembles a thin flour paste, but when viewed through a small microscope it reveals innumerable animalcules. A. The substance is tripoli or infusorial earth, sometimes called diatomaceous silica.

(12) W. M. R. asks: 1. How to set a common slide valve in a stationary, locomotive, or marine engine. A. To explain slide valve adjustment for various kinds of engines would take up too much space for the department of Notes and Queries. We recommend to you a book on "The Slide Valve Practically Explained," by Rose, $1, or "The Slide Valve," by N. P. Burgh, $2, and "A Practical Treatise on Valve Gear," by McCord, $3, all or any of which we can furnish. 2. What is the rule for calculating the safe working pressure of steam boilers when the material dimension of construction is known? A. For cylindrical boiler shells, divide the tensile strength of the iron by the diameter of the shell in inches. Deduct one-half of quotient for single rivets, or one-third, if double riveted. Multiply the remainder by twice the thickness of the iron in decimals of an inch, and divide this sum by 4, as a factor for safety in working pressure. Thus for a cylindrical tubular boiler of good iron and well stayed heads, 48 inches diameter, say for tensile strength of 48,000 pounds to the square inch, with five-sixteenths inch shell, double riveted, we have 48,000 ÷ 48 inches = 1,000 less one-third = 667 × 0·625 = 416·8 ÷ 4 = 104 pounds maximum of safety. 3. What is the rule for calculating pressure of water to the square inch when the height is known? A. Multiply the height in feet by 0·433.

(13) C. N. V. C. asks: 1. How to tune up a set of glasses to use as musical instruments? A. Tones of musical glasses are dependent on the glasses and the amount of water used, this being determined by ear. 2. Where can the juice of the fruit of cajurio tree be obtained, and at what price? A. There is no such tree known to botanists. 3. Is there any cure for drunkenness, such as chloride of gold and other remedies? A. We have but little faith in cures for drunkenness. The taking of medicine will not produce abstinence in an individual. It is a question of will power. The so-called double chloride of gold is said to consist of:

Ammonia chloride	1 grain.
Aloine	2 grains.
Compound tincture of cinchona	3 ounces.
Water to make up	4 ounces.

No gold is found in the preparation, and therefore its name is not even reliable.

(14) C. H.—The continued application of any preparation of lead to the skin is full of danger. It can, beyond question, cause paralysis and other forms of nervous disturbance.

(15) J. H. writes: With 5 pounds of pressure (steam), how many feet or inches or what surface does it require to heat one hundred square feet of glass roof and sides of a greenhouse in order to maintain a night heat of 55 to 65 degrees in the house, while the thermometer outside ranges at 15 to 20 degrees below zero. Also, the boiler surface necessary, etc.? A. One square foot of heating surface to 8 square feet of glass. Wrought iron pipe is the best for steam. Place along the sides of the house, both below and above the benches, 1½ or 2 inch pipe, according to size of house. The boiler should have 1 square foot of heating surface to 6 square feet of radiating surface, and should have the water level in boiler not less than 4 feet below the floor of greenhouse. A horizontal tubular boiler is the best and most reliable. Steam heating for greenhouses requires that the fire should be stoked during the night as well as day. It is therefore not economical for small houses.

(16) H. W. asks for the best remedy to deafen a floor after the floor is laid, but not yet sealed? A. Nail furring strips on the sides of the beams 2 or 3 inches above their lower edge, and lath and plaster. Then cross-fur the beams with strips and lath and plaster for the ceiling.

(17) A. L. asks: What flux is used with hard solder? A. The usual flux for hard solder is borax. The common method of preparing it for use on small work is to grind it up with water into a cream on a slate or porcelain slab, and apply it to the joint and to the solder with a brush.

(18) J. G. S. asks: What can I mix with lead to make it harder to bend, and no harder to melt, for small castings in plaster moulds? A. A small percentage of antimony. Try type metal; it is an alloy of lead and antimony.

(19) W. S. asks if there is any simple way of making it more difficult to pick a watch from a vest pocket. I have had one watch picked out of my pocket, and don't care to lose another. A. Various kinds of safety pockets are in use, but probably the best way to prevent the removal of your watch from your pocket would be to wear a stout auxiliary chain around your neck, and carry it through the armhole of your vest.

(20) W. M. H. asks: What are the reasons why electric clocks (regulated by a chronometer in electric connection with them) are not in more general use in towns? A. We believe that the use of such clocks is constantly increasing. Probably they would come into more general use if it were not for the cheapness and reliability of common clocks.

(21) W. E. S. P. asks: What metal, if any, held near a permanent magnet, will strengthen the magnet? Can it be done in any way other than that commonly employed in the telephone? A. No metal in its normal condition, held near a magnet, will strengthen it, but by winding the magnet with copper wire, or any other electrical conductor, and sending a current through the conductor, you may increase the strength of your magnet.

(22) C. W. M. asks: What substance placed between a piece of steel and a magnet will stop the attraction of the steel to the magnet, that is, having the steel about an inch or so from the magnet? A. A large body of iron placed near or in contact with the pole of a magnet will asborb its magnetism; but no insulator of magnetism has been discovered.

(23) L. G. asks: Which wagon draws the lighter—the one with large wheels or the one with small wheels? A. The wagon with the larger wheel, as the leverage of a large wheel over obstructions is greater than that of a small wheel.

(24) W. L. C. asks: 1. Why would not a rapidly revolving disk of soft iron cut stone same as it does cold iron rails? A. We think the stone would rapidly wear away the soft iron disk. You could not expect to get the same effect upon the stone that is realized in the case of iron. 2. How can I harden iron or steel to make teeth for circular saw to cut stone? It is impossible to keep "borts" firmly in the saw. A. We do not think you can harden iron or steel so that it will answer for the teeth of circular saws for cutting stone, because the extremely hard steel is too brittle to maintain a cutting edge. Probably the best way to make steel extremely hard is to heat it to the required degree for hardening, and then plunge it into mercury. Care should be taken not to inhale the fumes of the mercury.

(25) W. H. H. asks: Will you tell me if the chrome battery is equivalent to two crowfoot batteries, and will they work on a ground connection for a telegraph line, and if so, how are they made up? A. One cell of bichromate battery when first set up is equal to two cells of gravity battery, but it rapidly runs down, so that the fair average would probably be about 1½ volts, and about 1½ times the electromotive force of a cell of gravity battery. For information on batteries consult SUPPLEMENT, Nos. 157, 158, and 159.

(26) W. C. R. writes: In making the dynamo electric machine of the SUPPLEMENT, No. 161, I am told by an electrician, connected with the electric light plant in this city, that the numbers 18 and 14 are not the best sizes to use, that a finer wire on the armature would increase the intensity, etc. A. The sizes of wire given for the dynamo described in SUPPLEMENT, No. 161, were for general purposes. Of course, if you desire a current of high tension, you can procure it only by the employment of finer wire. On the other hand, if you desire a current of low tension, for electro plating and similar purposes, you will need to wind your armature with No. 14 or 16 instead of 18, and the size of the wire on your field magnet should be correspondingly increased.

(27) J. R. W. asks: How is it that the ticking of the telegraph instrument can be heard over the telephone wire if the wires of each instrument run parallel with each other for a short distance? A. The ticking produced in the telephone is caused by the electrical impulse passing over the telegraph line. It is simply a matter of electrical induction.

(28) C. E. K. asks: Can persons learn telegraphy themselves, and receive by sound with an instrument without the aid of any one? A. We think you could attain fair proficiency in telegraphy by studying the subject with the aid of a suitable instrument, but you might fall into habits which could not be easily corrected. Better consult some good operator from time to time during your study and practice.

(29) F. H. F. asks: In what way are the teeth cut in wood saws, hack saws, and gig saws? A. In the smaller sizes they are generally cut in a milling machine; a number of saws being clamped together, so that one row of teeth will be cut through the whole series by one operation. The teeth in larger saws are cut one at a time by means of dies.

(30) C. A. Y. asks: 1. How large a gravity cell will it take to swing a one second pendulum which weighs about ten pounds, and how large should the electro-magnet and the wire thereon be? A. If your pendulum is properly constructed, two to three gravity cells ought to keep it in motion. You will probably require a magnet with cores ⅜ inch in diameter and 1⅛ inches long, wound with about six or eight layers of No. 24 wire. 2. By what process is the great heat obtained from the gasoline stoves or machines now used for analyzing and melting specimens of ore? A. The flame is urged by means of a blowpipe. Petroleum burners, on the principle of the atomizer, produce very intense heat. 3. How close may the flues be placed in a boiler to generate steam with the greatest rapidity for the amount of water? A. This depends so much on the diameter of the flue, the size of the boiler, and its position, that we are unable to give you a definite reply. However, half the diameter of the flue is probably a good distance for horizontal boilers.

(31) C. D. V. asks (1) how to make a storage battery which will give from 4 to 5 volts, its width and length not to exceed 4 inches, nor the thickness 1⅛ inches. A. We do not think a storage battery can be made to fulfill your conditions. A storage battery, to yield a current having an electromotive force of from 4 to 5 volts, will occupy considerably more space than 4x4x1⅛ inches. 2. Also tell me how long 16 Fuller bichromate cells, which are used to run a 16 candle power incandescent lamp, will last without renewal? A. We think you will find it impossible to run a 16 candle lamp with 16 Fuller bichromate cells. The Fuller bichromate battery is not so well adapted to continued use as the Bunsen bichromate battery. The Bunsen battery requires renewal once in from 4 to 6 days.

(32) W. G. asks how to make a battery to be carried in a belt, the two poles of which I want to apply to the body by means of conducting cords and disks; one that will last a week or so without recharging. Do not want a very strong current, or it will burn the skin. Something that will take the place of an electric belt. A. To make such a battery as you require, take a plate of zinc and a plate of copper of the same size, and cut 24 sheets of blotting paper about the size of the plates, saturate 12 of the sheets of blotting paper with a saturated solution of sulphate of copper, and saturate the remaining 12 sheets of blotting paper with a weak solution of sulphate of zinc. Place the two packages of blotting paper together, then apply the copper plate to the paper saturated with the sulphate of copper, and the zinc plate to the paper saturated with sulphate of zinc; now solder a wire to each plate and connect the wires with your electrodes. The plates, together with the wet paper, may be wrapped up in thin sheet rubber, or you may make a rubber case for inclosing the battery.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

January 26, 1886,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Aerial ship, H. Hunnicutt ... 334,866
Air brake, A. J. Wisner ... 335,049
Alarm. See Burglar alarm.
Animal trap, I. S. Krick ... 334,784
Animal trap, G. A. & A. A. Long ... 335,061
Animal trap, D. Phillips ... 335,089
Ax blank, H. Hammond ... 334,948
Axle, car, Wilhelm & Demmer ... 335,003
Back band hook, J. B. Moore ... 334,884
Bag and twine holder, L. Q. Edmiston ... 335,063
Bag holder, fruit, I. H. Kizer ... 335,076
Banjo tail piece, R. H. Benary ... 334,734
Barber's pole, R. F. Walter ... 334,912
Bark cutting machine, J. C. Hagerty ... 334,859
Baskets, machine for making and driving staples in handles of, H. C. Ward ... 334,913
Battery. See Galvanic battery.
Bed, combination folding, A. T. McCurry ... 334,880
Beehive, M. N. Ward ... 334,914
Bellows, G. T. Campbell ... 334,934
Belting, woven, F. Reddaway ... 334,895
Bench. See Wash bench.
Billiard cue tip fastener, H. A. Harmer ... 334,861
Blasting barrel, measuring rule, and drill hole scraper, combined, J. E. Fehn ... 334,765
Blind slat adjuster, P. Rundquist ... 334,093
Bobbin winder, W. Connolly ... 335,019
Boiler. See Wash boiler.
Boiler purifier and feeder, H. F. Hayden ... 334,774
Bolt for shutters, etc., H. J. Hunsicker ... 334,953
Book holder, L. W. Noyes ... 335,085
Boot or shoe fastening device, G. H. Bliss ... 334,738
Bottle and stopper, J. H. B. Howell ... 334,865
Bottle packing box, E. A. Conkling ... 334,748
Bottle rinser, R. Preston ... 334,805
Bottle washer, G. P. Goulding ... 335,068
Bottles, stand for holding and sealing, Reynolds & Weldon ... 334,983
Box. See Bottle packing box.
Bracelet, A. V. Briesen ... 334,844
Brake. See Air brake.
Breakwater, L. W. Leeds ... 335,032
Brush, bottle washing, J. Buchheit ... 335,052
Buckle, C. J. Cooper ... 334,750
Buckle and strap loop, combined, R. W. Jones ... 334,870
Buckle, waist belt, L. & H. A. Sanders ... 334,901
Buckle, suspender, Chapman & Dalton ... 335,056
Buggy top support, J. J. Finney ... 334,856
Building and system for laying electric conductors therein, C. N. Fay ... 334,763
Building bracket, A. D. Hart ... 334,772
Burglar alarm, W. Eckersall ... 334,761
Burglar alarm, G. W. Nelson ... 334,888
Burner. See Vapor burner.
Butter, making, W. A. Murray ... 335,084
Cab register, A. O. Jennings ... 334,780
Calipers and dividers, rapidly adjusting nut for, C. P. Fay ... 334,764
Can. See Liquid can.
Capsule machine, T. C. Merz ... 334,792
Car coupling, W. C. Cowen ... 334,751
Car coupling, N. W. Hawkenson ... 334,863
Car coupling, E. L. Matteson ... 334,962
Car coupling, R. Powell ... 334,804
Car door cleat or fastener, railway, J. B. Robinson ... 335,092
Car door lock, freight, A. B. Barnard ... 334,840
Car seat arm, J. Denver ... 334,756
Car seat, reversible, J. Lemman ... 334,957
Car wheel lathe, J. R. Williams ... 334,832
Carbonizing mould, T. A. Edison ... 334,853
Carbureting lamp, J. E. Dery ... 334,851
Carding machines, mote and dirt collecting attachment for, S. D. Keene ... 334,872
Carpet sweeper, Bissell & Drew ... 335,010
Carrier. See Hay carrier.
Cartridge extractor for breakdown guns, J. Deeley, Jr ... 335,021
Carving fork, L. B. Bethell ... 334,841
Case. See Ticket case.
Castings, manufacturing flanged, J. Sullivan ... 334,821
Ceiling, fireproof, C. Toope ... 334,996
Chair. See Folding chair.
Check rein hook, J. A. Gorly ... 334,769
Check rower and corn planter, J. W. Buffington ... 334,846
Chuck, G. A. Barnes ... 335,009
Chuck, lathe, E. Pement ... 334,898
Churn, cream testing, Andrews & Burnap ... 334,924
Clevis, H. F. Dunn ... 334,760
Clamping bracket, T. Thorn ... 334,825
Clipper, hair, P. E. Beaudette ... 334,733
Clock, electric, J. E. Carey ... 334,745
Clocks, electro-magnetic device for winding, W. F. Sweet ... 334,822
Clothes drier, R. F. Redick ... 334,982
Clothes rack, E. G. Hurd ... 335,073
Cock and tap, C. M. P. Lefit ... 334,787
Coffee or tea pot, Gronemeyer & Polster ... 335,070
Coffee roaster, T. B. C. Burpee ... 334,742
Coffin, G. Reynolds ... 334,808
Comb. See Curry comb.
Cooler. See Milk cooler.
Cot and stretcher, folding canvas, S. F. Seely ... 334,986
Cotton gin, Livingston & McBride ... 334,875
Cotton opener and lapper, J. C. Potter ... 335,089
Coupling. See Car coupling. Draught coupling. Thill coupling.
Cow tail fetter, B. S. Slinn ... 334,906
Cultivator, spring, W. J. Browne ... 335,013
Curry comb, F. I. Howe ... 335,072
Cutter. See Tube cutter.
Cutting double pile fabrics, mechanism for, C. R. Garratt ... 334,947
Damper regulator, N. C. Locke ... 335,080
Dental engine, J. O. Scott ... 334,985
Detector. See Gas leak detector.
Ditching machine, J. L. Senteney ... 334,903
Door closer, automatic, D. T. Winter ... 334,884
Draught coupling, W. W. Waterberry ... 334,999
Draught equalizer, J. M. Langston ... 334,874
Drier. See Clothes drier. Grain drier. Lumber drier.
Drill attachment, H. S. Spratley ... 334,817
Drill for wood, etc., R. D'Heureuse ... 334,757
Drip cup, G. Ashby ... 335,007
Dry board hook, T. F. Barnum ... 334,927
Dyeing apparatus, A. Moran ... 334,798
Dyeing apparatus, O'Connell & Weeden ... 334,889
Eaves trough support, W. R. Wilcox ... 334,831
Edger, gang, Vail & Solliday ... 334,997
Egg tray, N. F. Tipton ... 334,826
Electric furnace and operating the same, A. H. Cowles ... 335,058
Electric furnace for metallurgic operations, E. H. & A. H. Cowles ... 335,059
Electric lighting system, H. M. Doubleday ... 335,060
Electric machines, commutator for dynamo, N. Tesla ... 334,823
Electrical circuits, apparatus for automatically testing, G. F. Milliken ... 334,969
Electrical distribution, system of, F. J. Sprague ... 335,045
Electrical distribution, system of, S. S. Wheeler, 335,048, 335,099
Elevator. See Water elevator.
Elevator valves, controlling, R. C. Smith ... 334,907
Embroidering machine, F. Schnelle ... 335,094
Engine. See Dental engine. Rotary engine. Traction engine.
Engine cylinder lubricator, M. W. Hall ... 334,860
Explosive compound, C. W. A. Zadek ... 335,006
Fabric turfing implement, J. W. Weddel ... 334,915
Farm gate, J. M. Moose ... 334,797
Felly for wheels, metallic, J. W. Haworth ... 334,949
Fence, A. Newkirk ... 334,973
Fence, E. F. Shellaberger ... 334,988
Fence tension apparatus, wire, W. N. Parrish ... 334,801
Fifth wheel, vehicle, C. C. Pinckney ... 335,088
Filter, C. W. E. Piefke ... 335,040
Fire alarm box, T. F. Gaynor ... 335,025
Fire alarm signal, T. F. Gaynor ... 335,027
Firearm, breech-loading, W. H. Shear ... 335,043
Firearm, magazine, P. A. Altmaier ... 334,731
Fire escape, Brueningsen & Quinn ... 334,741
Fireplace, gas burning, E. F. MacKusick ... 334,877
Fluids, apparatus for lifting and controlling the flow of, W. T. Messinger ... 334,793
Folding chair, P. Noel ... 335,037
Folding table, J. P. Gage ... 334,946
Food warmer or night-light apparatus, infant's, S. Clarke ... 334,747
Fork. See Carving fork. Hay fork.
Frying pan, T. O. Inman ... 334,867
Furnace. See Electric furnace. Heating furnace. Tire heating furnace.
Gauge. See Micrometer gauge.
Galvanic battery, F. L. Lathrop ... 334,788
Galvanic body wear, J. Mayer ... 334,879
Gas leak detector, I. M. O'Donel ... 334,890
Gas motor engines, slide and passage for, N. A. Otto ... 335,038
Gas pressure regulator, R. F. Hatfield ... 334,773
Gas supply systems, stop valve for, E. C. Merrill ... 334,882
Gate. See Farm gate. Railway gate. Railway crossing safety gate.
Gate, D. Giles ... 335,028
Generator. See Steam generator.
Glass, manufacture of articles made from toughened, F. B. A. R. De la Bastie ... 334,754
Gold and silver ores, desulphurizing, J. H. Mathews ... 334,961
Grain drier, C. F. Shedd ... 334,987
Grater, vegetable, P. Blum ... 334,931
Guard. See Window guard.
Halter trimming, E. Deming ... 334,755
Hame, H. A. Hughes ... 334,775
Hammers, die and bie block for forge, J. H. Baker (r) ... 10,690
Hammock, C. Shepardson ... 334,990
Handle, F. B. Smith ... 334,993
Harness holdback attachment, C. R. Miller ... 334,888
Hat wire, C. S. Andrews ... 334,923
Hay carrier, F. A. White ... 334,917
Hay fork, J. Ney ... 335,036
Hay press, H. F. Blank ... 334,843
Hay press, portable, Burnette & Porter ... 335,053
Heating furnace, D. L. Jones ... 334,781
Hinge, mirror, P. Forg ... 334,944
Hitching device, W. G. Mauk ... 334,963
Hitching device, W. H. Vaughn ... 334,827
Hoisting apparatus, E. O. Rood ... 334,810
Hoisting machine, F. X. Brenner ... 334,740
Holder. See Bag holder. Bag and twine holder. Book holder. Ribbon holder. Rope holder. Sash holder.
Hook. See Check rein hook. Dry board hook.
Hoop pole sawing machine, E. Powell ... 335,090
Hoop splitting machine, H. Weitzel ... 335,000
Hose, A. T. Holt ... 334,951
Hose nozzle, J. O'Donnell ... 334,800
Indicator. See Station indicator.
Injector, A. S. Eberman ... 334,852
Insulating electric cables, R. A. Denison ... 334,850
Iron. See Soldering iron.
Jars, adjustable bail and cover holder for, M. Alston ... 334,922
Journal and bearing, F. B. Torrey ... 335,047
Jump seat iron, A. F. Shuler ... 334,905
Key, E. B. Slater ... 334,814
Kitchen cabinet, J. A. Mullen ... 335,054
Kitchen cabinet, J. F. Randolph ... 334,894
Knob attachment, O. Stoddard ... 334,819
Knob, door, W. H. Comstock ... 334,937
Label, W. Rampe, Jr ... 334,981
Ladder step, H. Ayres ... 335,051
Lamp, candle, W. Damerel ... 335,020
Lamp, miner's, H. J. Richards ... 335,041
Land roller, G. L. Calkins ... 334,744
Land roller, E. W. Knowles ... 335,077
Latch and lock, combined, S. F. Estell ... 335,064

© 1886 SCIENTIFIC AMERICAN, INC

Latch and lock, combined, O. L. Meisler..... 334,887
Latch, reversible, W. E. Sparks..... 334,815
Letters to composition surfaces, attaching composition, J. H. La Bau..... 334,786
Leverage, device for gaining, P. Harrod..... 334,771
Life saving apparatus, tripod for, C. H. McLellan..... 335,083
Lifter. See Transom lifter.
Liquid can, J. Graves..... 335,069
Lock. See Car door lock.
Lubricator. See Engine cylinder lubricator.
Lumber drier, G. H. Derby..... 334,940
Mail bag catcher, Allen & Harrod..... 334,921
Mainspring winder, O. C. Dow..... 335,023
Mat, stair, or step tread or pad, A. Spadone..... 334,994
Match, F. W. Farnham..... 335,065
Meat cutting machine, F. Lindner..... 334,789
Mechanical movement, F. Reed..... 334,806
Micrometer gauge, G. B. Grant..... 334,770
Milk cooler, W. R. Fowler..... 334,767
Milker, cow, R. D. Roth..... 335,042
Mill. See Sawmill. Windmill.
Mitten, reversible, G. P. Ross..... 334,900
Mould. See Carbonizing mould.
Moulder's pattern plate, J. R. Davies..... 334,753
Mop, E. F. Wilson..... 335,005
Motion, device for converting, S. L. Shellenberger..... 334,989
Mower, E. Dickinson..... 334,758
Mowing machine, B. Elmore..... 334,762
Mowing machine, sickle driver attachment for, Walker & Caulk..... 334,828
Nail feeding mechanism, C. D. Rogers..... 334,898
Nut lock, W. J. McTighe..... 334,790
Nut lock, G. Woodring..... 334,836
Oil upon seas, apparatus for distributing, F. D. Montague..... 335,085
Pail bottoms, machine for bending, Leonard & Stevens..... 335,079
Pan. See Frying pan.
Pantaloons protector, G. Kinner..... 334,783
Paper and fixture, toilet, O. H. Hicks..... 334,864
Paper folding machine, J. H. Stonemetz..... 335,096
Paper making machine, S. H. Hodges..... 335,030
Paper making, pulp digester for, C. C. Springer..... 335,046
Paper pulp, machine for forming pails from, H. R. Butterfield..... 335,055
Paper vessels, machine for trimming the ends of, Leonard & Stevens..... 335,078
Pencil sharpener, G. H. Phelps..... 334,803
Pendulum, C. A. Mahony..... 334,958
Photographic negatives, apparatus for washing, W. H. H. Whiting..... 335,002
Piano action, upright, I. Fuso..... 334,768
Piano case, upright, S. Brambach..... 334,933
Pipes, clamp for stopping leaks and bursts in, W. W. Knight..... 334,873
Plane, A. Doll..... 334,943
Planter check row attachment, corn, Jordan & Cole..... 335,075
Planter, corn, J. A. Cherry..... 334,746
Planter, seed, Roden & Morgan..... 334,897
Plow and double shovel frame, turn, W. T. Claycomb..... 334,847
Plow and harrow, combined, A. McDonald..... 335,082
Plow, cultivator, and harrow, combined, C. Audirsch..... 335,008
Plow point, P. D. Anderson..... 334,837
Pot. See Tea or Coffee pot.
Preserving by gas, apparatus for, L. McMurray... 334,966
Preserving fruits, apparatus for, L. McMurray.... 334,967
Press. See Hay press.
Pressure regulators, diaphragm for, N. C. Locke.. 335,033
Printing machine sheet delivery apparatus, G. P. Fenner..... 335,066
Printing machine sheet delivery apparatus, C. B. Maxson..... 334,964
Protector. See Pantaloons protector. Tree protector. Wall protector.
Pulley, C. S. Wardwell..... 334,998
Pump, R. Bean..... 334,732
Pump, J. W. Collier..... 334,936
Pump, H. C. Montgomery..... 334,795
Quilting machine, W. Koch..... 334,955
Rack. See Clothes rack.
Railway car signal, S. Forman..... 334,766
Railway chair, J. M. Fennerty..... 335,067
Railway crossing safety gate, R. C. Blackall..... 334,930
Railway gate, automatic, J. K. Patterson..... 334,892
Railway gripper, cable, G. B. Bryant..... 334,845
Railway switch, W. Wharton, Jr..... 334,916
Recorder. See Steam engine recorder.
Reflector, electric lamp, D. W. Guernsey..... 334,858
Register. See Cab register.
Regulator. See Damper regulator. Gas pressure regulator. Roller mill feed regulator.
Ribbon holder, F. D. Moore..... 334,796
Roaster. See Coffee roaster.
Roller. See Land roller.
Roller and pulverizer, J. L. Sandelbach..... 334,984
Roller mill feed regulator, J. R. Palmer..... 334,891
Roofing, furniture, etc., composition of matter for, A. A. Oliver..... 334,974
Rope holder, S. H. & C. E. Manners..... 334,878
Rotary engine, J. W. Emerson..... 334,854
Rotary steam engine, D. G. Wherry..... 335,001
Rowing apparatus, W. Ciencoski..... 334,935
Ruler for slates, Bolton & Jargensen..... 334,932
Safe, sectional kitchen, W. C. Campbell..... 335,014
Safety attachment, J. H. Barnes..... 334,926
Sash balance, A. F. Johnson..... 334,868
Sash fastener, F. L. Rosentreter..... 334,899
Sash holder, J. H. Felmlee..... 335,024
Saw, crosscut, J. J. Parker..... 335,087
Saw guide, band, Stephens & Hanson..... 334,818
Sawmill, band, E. Benjamin..... 334,735
Scales, platform for railway track, T. M. Taylor.. 334,995
Scarfs, making sailor knot, H. Heath..... 335,071
School seat and desk, W. J. Perkins..... 334,802
Screen. See Window screen.
Screwdriver, watchmaker's O. L. Neal..... 334,886
Seat. See School seat.
Sewing machine, book, R. Frank..... 334,945
Sewing machine, buttonhole, T. F. Hagerty..... 335,029
Sewing machine button holding and feeding attachment, H. H. Cummings..... 334,752
Sewing machine feeding mechanism, D. H. Coles. 335,018
Sewing machine shuttle carrying mechanism, D. H. Coles..... 335,017
Shoddy purifier, E. M. Hulse..... 334,776, 334,777
Signal. See Fire alarm signal. Railway car signal.
Signal apparatus, J. R. Pheeney..... 334,980
Skate, coasting, E. S. Kingston..... 334,954
Skate, fastening, U. Olsen..... 334,975
Skate, roller, G. Blum..... 334,739
Skate, roller, W. Robinson..... 334,896
Skate, roller, Shute & Stevens..... 334,992
Skaters, apparatus for assisting roller, C. Johnson..... 335,031
Soldering iron, H. M. Dixon..... 334,942
Soldering machine, can, W. D. Brooks..... 335,011, 335,012
Sole laying machine, Coupal & Wood..... 335,016
Speed of shafting, machinery, etc., apparatus for indicating the, W. B. Mason *et al*..... 334,960
Spinning machine, R. Walmsley..... 334,830
Spooler guide, A. J. Nichols..... 334,799
Staple machine, J. Thomson..... 334,909
Station indicator, G. E. Schlegelmilch..... 334,902
Station indicator, D. Wilson..... 335,004
Staves, machine for jointing compressed bent, E. M. Jewett..... 335,074
Steam boiler and pipe coupling, C. B. Manville.... 334,959
Steam engine recorder, J. & H. R. Illingworth, 334,778, 334,779
Steam engine slide, J. G. Schumacher..... 334,811
Steam generator, W. A. Hodgkins..... 334,950
Steamboat and water wheel, J. W. Thomas..... 334,824
Stirrup, L. D. O'Roark..... 334,976
Stove, combined self-feeding cooking and heating, J. H. Nevins..... 334,971
Sucker rod, R. H. Black..... 334,929
Sugar bars and plates, manufacturing, A. Fesca.. 334,855
Sugar, dissolving and straining, G. M. Newhall.... 334,972
Sugar, manufacturing grape, F. Soxhlet..... 335,044
Sulphuring tube, R. A. Wittemann..... 335,050
Swimming apparatus, W. J. Corbett..... 335,015
Swing, S. B. McCorkle..... 334,965
Table. See Folding table.
Table and desk, combined, J. G. Peace..... 334,977
Tap holes of casks, apparatus for automatically closing, Minnitt & Vickers..... 334,970
Target, flying, F. C. Damm..... 334,848
Target traps, arm for flying, F. C. Damm..... 334,849
Targets, making, F. Kimble..... 334,782
Telegraph call box, J. H. La Bau..... 334,785
Telegraph sounder, A. S. Keating..... 334,871
Telegraphy, fire alarm, T. F. Gaynor..... 335,026
Thill coupling, I. W. Archibald..... 334,838
Thill coupling, G. Tyler..... 334,910
Thill couplings, anti-rattler for, G. W. Blair..... 334,842
Thrasher, traveling, N. S. Wilson..... 334,833
Thrashing machine, T. E. Gilkeson..... 334,857
Ticket case, W. M. Stevenson..... 335,095
Tire heating furnace, M. Hoyt..... 334,952
Tobacco, cigars, etc., cabinet for, C. N. Swift..... 335,097
Tobacco cutting machine, C. A. Sturtevant..... 334,820
Toboggan, C. E. Babcock..... 334,925
Tool, combination, O. D. Harmon..... 334,862
Toy, C. B. Moreton..... 334,885
Toy bird, D. F. Shaw..... 334,812
Traction engine, E. Penney..... 334,978
Transom lifter, J. M. Overell..... 335,086
Trap. See Animal trap.
Tree box, A. R. Reese..... 334,807
Tree protector, D. L. Byler..... 334,743
Trellis for garden crops, W. A. White..... 334,918
Tricycle, H. Baines..... 334,839
Truss, G. Miller..... 334,968
Tube cutter, D. L. Baughman..... 334,928
Type writing machine, H. G. Wood..... 334,920
Underground conduit, T. A. B. Putnam..... 335,091
Valve, balanced, D. A. Woodbury..... 334,835
Vapor burner, W. Bliesner..... 334,737
Vehicle, W. D. Smith..... 334,908
Vehicle top bow socket, J. M. Perkins..... 334,979
Vehicle, two-wheeled, J. J. Deal..... 334,939
Vehicle, two-wheeled, H. Shogren..... 334,991
Vehicles, apparatus for starting and propelling wheeled, L. Duhamel..... 335,062
Velocipede wheel, A. E. Wallace..... 334,829
Vise, J. J. Spilker..... 334,816
Wagon, delivery, T. Dissett..... 334,759
Wall protector for steam coils, R. B. Miller..... 334,794
Wash bench, G. J. Cline..... 335,057
Wash boiler, G. Bergenheim..... 334,736
Washer. See Bottle washer.
Watch movement, P. Conver..... 334,749
Water closet, J. J. De Rycke..... 334,941
Water closet, J. Vladyka..... 334,911
Water closet valve, J. D'Este..... 335,022
Water elevator, R. C. Dugan..... 335,061
Weather strip, A. F. Van Dolsen..... 335,098
Wells, ground screw for boring, S. Wickizer..... 334,919
Wheel. See Fifth wheel. Steamboat and water wheel. Velocipede wheel.
Windmill, A. Sherwood..... 334,813
Window guard, M. McLean..... 334,881
Window screen, E. Louderback..... 334,876
Wire, etc., mechanism for winding, S. W. Robinson..... 334,809
Wrapper for coins and other small articles, F. O. Butterfield..... 335,054
Wringer roll, D. Lampson..... 334,956
Yarn stripper, A. Shaver..... 334,904
Yoke, neck, R. T. Cook..... 334,933
Yoke, neck, S. D. Mehew..... 334,791

DESIGNS.

Carpet, T. J. Stearns..... 16,494
Electric battery zinc, I. W. Litchfield..... 16,492
Fireplace back, Q. S. Backus..... 16,489
Pen protector, A. Fraser..... 16,491
Posing chair, C. A. Schindler..... 16,493
Type, printing, W. Barnhart..... 16,490

TRADE MARKS.

Bitters and tonic, stomach, A. A. Ulman..... 12,975
Furniture nails, A. Gallais & Co..... 12,969
Liniment, E. H. Perkins..... 12,974
Lithographs, Armor Lithographing Company..... 12,963
Paints and varnishes, drier for, Lefranc & Co..... 12,971
Paper, fine writing, S. Worthinton..... 12,977
Paper for water closets, medicated Manila, B. T. Hoogland..... 12,970
Soap powders, Miller & Bobst..... 12,973
Stoves, heating and cooking stoves, including gasoline and oil, Western Stove Manufacturing Company..... 12,976
Surfacers, japans, stains, paints, and varnishes, Chicago Varnish Company..... 12,968
Thread on spools, J. Chadwick & Brother..... 12,964
Thread on spools, white and colored, J. Chadwick & Brother..... 12,965
Thread on spools, white and colored cotton, J. Chadwick & Brother..... 12,966, 12,967
Wall paper, embossed or relief, Manhattan Wall Paper Company..... 12,972

A Printed copy of the specifications and drawing of any patent in the foregoing list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 361 Broadway, New York. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, at a cost of $40 each. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

GET THE BEST AND CHEAPEST

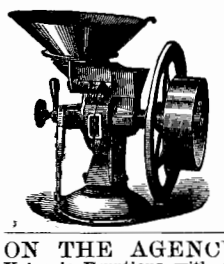
J. A. FAY & CO.,
(Cincinnati, Ohio, U. S. A.)
Exclusive Agents and Importers for the United States of the
CELEBRATED
PERIN BAND SAW BLADES,
Warranted **superior to all others in quality, finish, uniformity of temper, and general durability.** One **Perin Saw** outwears **three** ordinary saws.
Manufacturers of Planing Machines and other Patent Wood Working Machinery.

GLYCERINE AND ITS USES.—A valuable and interesting paper by F. H. Alcock. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **496.** Price 10 cents. To be had at this office and from all newsdealers.

TRY DREER'S GARDEN SEEDS
PLANTS, BULBS
and **Requisites.** They are the **BEST** at the **LOWEST PRICES. Calendar for 1886** sent for two 3c. stamps.
HENRY A. DREER,
714 CHESTNUT ST., PHILADA.

Type setting, etc., easy by printed directions. For **business** or **home use** or money making. For old or young. Send 2 stamps for catalogue of **presses, type, cards, paper, etc., to factory.**
Card Press, $8. Circular Size, $8. Newspaper Size, $44.
KELSEY & CO., Meriden, Conn.

ACETYLENE.—CHEMICAL COMPOSITION. Properties, mode of preparation, with 2 engravings of apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **466.** Price 10 cents. To be had at this office and from all newsdealers.



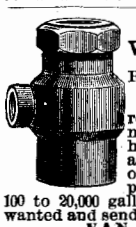
QUAKER CITY
Double Reduction
GRINDING MILL.
—FOR—
Corn and Cob Feed & Table Meal. Drew *First Prem.* Penna. State Fair.
SEND FOR CIRCULAR.
A. W. Straub & Co., 3737 Filbert Street, Philadelphia, Pa.

ON THE AGENCY OF WATER IN Volcanic Eruptions, with some observations on the Thickness of the Earth's Crust from a Geological Point of View, and on the Primary Cause of Volcanic Action. An interesting paper, read before the Royal Society by Prof. Joseph Prestwitch. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **496.** Price 10 cents. To be had at this office and from all newsdealers.

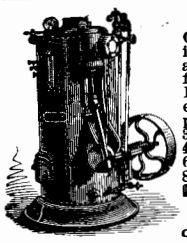
VIOLIN OUTFITS

Consisting of Violin, Box, Bow and Teacher, sent to any part of the United States on 1 to 3 days' trial before buying.
Violin Outfits at $4, $8, $15 & $25 each. Send stamp for Beautiful Illustrated 96 page Catalogue of Violins, Guitars, Banjos, Cornets, Flutes, Strings of all kinds, Harmonicas, Organ Accordeons, Music Boxes, &c. LOWEST PRICES. Mail Orders a Specialty. C. W. STORY, 26 Central St. Boston, Mass.

SUNLIGHT AND THE EARTH'S ATMOSPHERE.—A lecture by Prof. S. P. Langley, pointing out that the atmosphere is not transparent, as it seems to be, and that the true color of the sun is blue, rather than white, as it appears to be. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **496.** Price 10 cents. To be had at this office and from all newsdealers.



INFORMATION
For Users of Steam Pumps.
Van Duzen's Patent Steam Pump
Requires { No Packing or Oil, / No Repairs or Skill, / No Care or Attendance. } Is Reliable.
Can pump any kind of liquid; ever ready; no moving parts; all brass; cannot clog nor get out of order; fully tested; hundreds in daily use; every pump guaranteed; not like cheap Pumps made of Iron; all sizes to 6 inch discharge; prices from $7 upward; capacities from 100 to 20,000 gallons per hour. State for what purpose wanted and send for Catalogue of "Pumps."
VAN DUZEN & TIFT, Cincinnati, O.



BOOKWALTER ENGINE.
Compact. Substantial. Economical, and easily managed; guaranteed to work well and give full power claimed. Engine and Boiler complete, including Governor. Pump, etc., at the low price of

3 HORSE POWER.....	$240 00
4½ " "	280 00
6½ " "	355 00
8½ " "	440 00

Put on cars at Springfield, O.
JAMES LEFFEL & CO., Springfield. Ohio, or 110 Liberty St., New York.

THE AMERICAN OIL AND GAS Fields.—A general account of the petroleum industry in America, by Pros. James Dewar, F.R.S. Tracts where oil is found. Manner of obtaining oil. Relations of gas to oil. Analyses of oil gas. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **498.** Price 10 cents. To be had at this office and from all newsdealers.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN

Remington Standard Type-Writer

Purchasers permitted to return by Express C. O. D. for full purchase price at any time within thirty days, thus giving an opportunity for comparison with other machines.
Wyckoff, Seamans & Benedict,
339 Broadway New York.

ICE-BOATS — THEIR CONSTRUCTION and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Horsfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **1.** The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

Cutting-off Saw and Gaining Machine.

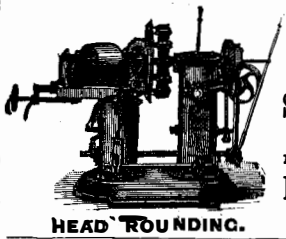
Special Machines for Car Work, and the latest improved Wood Working Machinery of all kinds.
C. B. Rogers & Co.,
NORWICH, CONN.,
AND
109 Liberty St., N. Y.

DOUBLE BOATS.—TWENTY-ONE ILlustrations of patented double boats, the gen ral construction and plan of which are so clearly shown as to need no detailed description. Name of patentee and date of patent accompanying each diagram. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **232.** Price 10 cents. To be had at this office and from all newsdealers.

EPPS'S
GRATEFUL—COMFORTING.
COCOA

THE NATIONAL TRANSIT COMpany's Pipe Lines for the Transportation of Petroleum to the Seaboard. Discovery of petroleum. Former modes of transportation. The origin of pipe lines. General description of the longest line in use. Illustrated with map and profiles. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **496.** Price 10 cents. To be had at this office and from all newsdealers.

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116.** Price 10 cents. To be had at this office and of all newsdealers.



BARREL, KEG, HOGSHEAD, AND Stave Machinery
Over 50 varieties manufactured by
E. & B. HOLMES,
HEAD ROUNDING. **Buffalo, N. Y.**

FUEL OF THE FUTURE.—BY George Wardman. Historical notes on natural gas. Duration of the supply of natural gas. The economic question connected with its use. Its advantages as a fuel. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **497.** Price 10 cents. To be had at this office and from all newsdealers.

Syracuse Malleable Iron Works

ADVERTISERS Can learn the cost of any proposed line of Advertising at GEO. P. ROWELL & CO.'S NEWSPAPER Advertising Bureau, 10 Spruce St., New York. Send 10 cents for a 100-page pamphlet.

WORK **FOR ALL. $30** a week and expenses paid. Outfit worth $5 and particulars free. P. O. VICKERY, Augusta, Maine.

OUR **ODOMETER** attached to a wagon gives the miles traveled from 1-100 part to 1000, and repeats. The size of a dollar [2¾ oz.]. Price $3. Only never stood test of time. 3 wheels. No springs. A new principle in mechanics that would be well for every inventor to study, as there are hundreds of places in which it can be used. Right of use, reasonable. Will be mailed to inventors for $2. If patented on Sci. Am. Send for catalogue of our ARCHITECTURAL INSTRUMENTS. A FEW GOOD MEN WANTED to handle our goods.
McDONELL ODOMETER CO., 2 and 4 LaSalle Ave. Chicago, Ill.

LUMINOUS PAINT.—DESCRIPTION of Balmain's process of making phosphorescent paint, and also of the processes of Krause, Sherwood and Thow less. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **497.** Price 10 cents. To be had at this office and from all newsdealers.

PROPOSALS are hereby invited and will be received until 1st April, 1886, for lighting the city of Asheville, North Carolina, with electricity or gas. Lighting area about 1½ miles square. Population 6,000.
GEO. W. SCOTT, Alderman.
N. W. GIRDWOOD, "
A. RANKIN, "
February 13, 1886. Committee.

Barnes' Pat. Foot and Hand Power MACHINERY, $15.

Contractors and Builders, Cabinet Makers and Jobbers in Wood or Metal, who have no steam power, can, by using outfits of these machines, bid lower and save more money than by any other means for doing their work. Sold on trial. Illustrated Catalogue FREE.
W. F. & JOHN BARNES CO.,
Address 1999 Ruby St., Rockford, Ill.

AMERICAN STEAM BOILER INSURANCE CO.,
45 William Street, New York.
Write for Special Blanket Form No. 99; gives complete protection to property, and pays $5,000 for a life and $50 weekly for six months for injury.

Edco System
Of Arc and Incandescent Lighting.
Electric Light and Power.
Motors, Dynamos, Lamps, and Batteries in all varieties.
Electro-Dynamic Co., 224 Carter St., Philadelphia.
W. W. Griscom, Consulting Electrical Engineer.

© 1886 SCIENTIFIC AMERICAN, INC

Indispensable to Lumbermen, Farmers and Mechanics.
TWENTIETH THOUSAND.
JUST READY:

HANDBOOK OF USEFUL TABLES

Lumberman, Farmer and Mechanic.

Containing directions for finding the interest on any sum at 4, 5, 6, 7 and 8 per cent., Tables of Interest at 6 per cent., Wages per Month and Week, Board or Rent per Week, Board, Scantling and Plank Measure, Cubic Contents of Square and Round Timber, Cubic Contents of Round Timber when Squared, Logs reduced to inch Board Measure, Standard Contents of Logs, Wood Measure in Load and Pile, Cost of Wood, Cost of Lumber, Weight of grains per Bushel, Contents of Granaries, Bins, etc., Capacity of Cisterns, Weight of Seasoned Lumber per 1,000 feet, Weight of Solids per Cubic Foot, Liquors per Gallon, Wood per Cord, Length of Nails and Number in a Pound, and other Valuable Tables, besides Miscellaneous and Useful Information, etc. In one volume. 32mo, boards, 186 pages. Price, 25 Cents.

☞ *The above or any of our books sent by mail, free of postage, to any address in the world.*

☞ *Our Catalogue of Practical and Scientific Books, 96 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS,
810 Walnut Street, Philadelphia.

One Volume, thick 8vo, cloth, 777 pages, 143 illustrations and five folding plates. Price, $12.50.

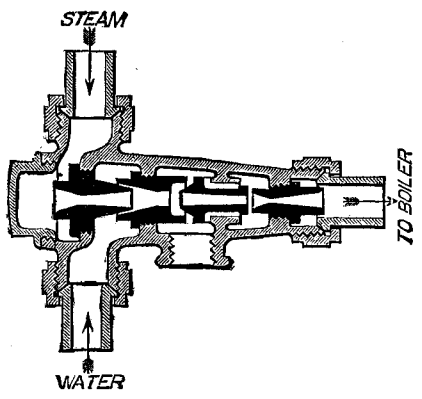
THE
Theory of Stresses
IN
GIRDERS and SIMILAR STRUCTURES,
WITH
PRACTICAL OBSERVATIONS ON THE STRENGTH AND OTHER PROPERTIES OF MATERIALS.
BY
BINDON B. STONEY, LL.D., F.R.S.
Member of the Institution of Civil Engineers.

New edition, revised, with numerous additions on Graphic Statics, Pillars, Steel, Wind Pressure, Oscillating Stresses, Working Loads, Riveting, Strength and Tests of Materials.

D. VAN NOSTRAND, Publisher,
23 Murray and 27 Warren Sts., New York.
*** *Copies sent to any part of the United States prepaid, on receipt of price.*

IT PAYS To sell our Rubber Stamps. Free Catalogue to agents. FOLJAMBE & Co., Cleveland, O.

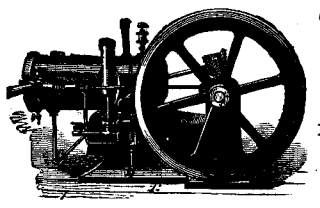
SMALL STEAM YACHTS. Steam Launches, Marine Engines and Boilers, and Propeller Wheels. Send for free Illustrated Catalogue. CHAS. P. WILLARD & CO., 282 Michigan St., CHICAGO.



THE NEW "GRESHAM" PATENT
Automatic Re-Starting Injector.

Invaluable for use on Traction, Farm, Portable, Marine, and Stationary Engines of all kinds. No Handles required. Water Supply very difficult to break. Capability of restarting immediately, automatically, after interruption to feed from any cause. Reliable and Cheap.

Sole Manufacturers in the United States and Canada,
Nathan Manufacturing Co.,
92 & 94 LIBERTY ST., NEW YORK.
SEND FOR CATALOGUE.

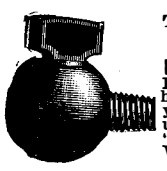


GAS ENGINES.
Best in principle, workmanship, and materials.
An unequaled small Motor adapted to all uses.
When the motor is not at work, the expense of running it ceases.
Simple, Safe, Economical, Durable. No extra insurance.
Four sizes: 1 H. P., ½ H. P., 1 man power, and a Sewing Machine Motor.
Our Gas Engines will work satisfactorily when attached to Gasolene Machines.
Send for Illustrated Catalogue.
ECONOMIC MOTOR CO.,
Office and Salesrooms, 9 CORTLANDT ST., NEW YORK.

NEW YORK BELTING AND PACKING CO.
Oldest and Largest Manufacturers in the United States of

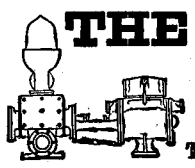
Vulcanized Rubber Fabrics
ADAPTED TO MECHANICAL PURPOSES.
RUBBER BELTING, PACKING, AND HOSE,
CORRUGATED
Mats and Matting, and Stair Treads, &c.
BICYCLE TIRES, CAR SPRINGS.
JOHN H. CHEEVER, Treas. JOHN D. CHEEVER, Dep'y Treas.
New York Belting and Packing Co.,
Warehouse, 15 Park Row, opp. Astor House, N. Y.
Branches: 308 Chestnut Street, Phila., 167 and 169 Lake Street, Chicago, and 52 and 54 Summer Street, Boston.

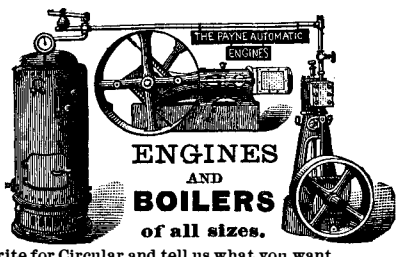
TO CLOCK CONTRACTORS.
The proprietor of a valuable invention for the uniformly correct time keeping of railway and ordinary clocks, and for compensation against vibration from railway traffic, is open to treat for the sale of the American patent. The English, Belgian, French and German patents are being successfully worked in Europe, and promise to become a standard system. Address
E. M. HILL, ESQ., SOLICITOR,
2 Old Serjeant's Inn, London, England.



The most successful Lubricator for Loose Pulleys in use.
VAN DUZEN'S PATENT
LOOSE PULLEY OILER.
Highly recommended by those who have used them for the past two years. Prices very reasonable. Every user of machinery should have our "Catalogue No. 55;" sent free.
VAN DUZEN & TIFT, Cincinnati, O.

THE CAMERON STEAM PUMP.
STANDARD OF EXCELLENCE.
30,000 IN USE.
ADAPTED TO EVERY POSSIBLE DUTY.
The A. S. CAMERON STEAM PUMP WORKS, Foot East 23d St., New York.



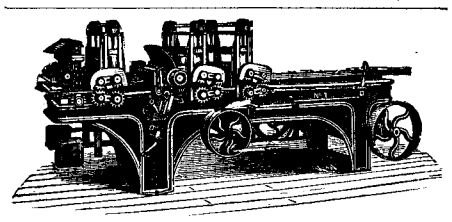


ENGINES AND BOILERS
of all sizes.
Write for Circular and tell us what you want.
B. W. PAYNE & SON, Drawer 1004, Elmira, N. Y.
Or address our New York Office.
Eastern Agents, HILL, CLARKE & CO., Boston, Mass.
Our patented Vertical Boiler will not prime. No danger of burning flues.

Especially for Steam Hammers.
MILLER'S PACKING.
Unequaled for water packing, and for oil pumps. In rope form of all sizes, ⅛, ¼, ⅜, ½, ⅝, ¾, ⅞, 1", etc. All quantities, $1.25 per lb. *It is the most substantial Packing material ever put together!* Pack with it—take none out—add a round whenever there is room for it. MILLER PACKING WORKS,
1338 Buttonwood St., Philadelphia, Pa., U. S. A.

CABLED TRADE MARK

WANTED An active Man or Woman in every county to sell our goods. Salary $75 per Month and Expenses. Canvassing outfit and particulars FREE.
STANDARD SILVERWARE CO., Boston, Mass



WITHERBY, RUGG & RICHARDSON. Manufacturers of Patent Wood Working Machinery of every description. Facilities unsurpassed. Shop formerly occupied by R. Ball & Co., Worcester, Mass. Send for Catalogue.

ENGINEER'S POCKET BOOK. BY Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form. Price $4. This valuable work will be sent on receipt of price by MUNN & CO., New York.

2½c. **PULLEYS** ORDER FROM OUR "SPECIAL LIST." **4c.**
ROUGH THE John T. Noye Mfg. Co. **FINISHED**
BUFFALO, N. Y.

FREE TRIAL.—NERVITA speedily cures all effects of youthful errors. Nervous Debility, Involuntary Losses, Lost Manhood, and kindred affections. 12 cents postage. Free at office. **TRIAL** package Dr. A. G. OLIN CO., 180 E. Washington St., Chicago.

CURE FOR THE DEAF
PECK'S PATENT IMPROVED CUSHIONED EAR DRUMS **Perfectly Restore the Hearing,** and perform the work of the natural drum. Invisible, comfortable and always in position. All conversation and even whispers heard distinctly. Send for illustrated book with testimonials, **FREE.** Address F. HISCOX, 853 Broadway, N. Y.

FREE TO MEN Who suffer from **Nervous Debility,** *Lost Vigor, Exhausted Vitality, etc.* A FREE TRIAL PACKAGE Of the celebrated MARSTON BOLUS, together with *Sealed Treatise* and Testimonials, will be sent on receipt of 2 stamps. MARSTON REMEDY CO., 46 West 14th Street, New York.

PILES. Instant relief. Final cure in 10 days, and never returns. No purge, no salve, no suppository. Sufferers will learn of a simple remedy, Free, by addressing C. J. MASON, 78 Nassau St., N. Y.

TO WEAK MEN suffering from the effects of youthful errors, early decay, lost manhood, etc. I will send a valuable treatise (sealed) containing full particulars for home cure, free of charge. Address Prof. F. C. FOWLER, Moodus, Conn.

MEN ONLY. A Quick, Permanent Cure for Lost Manhood, Debility, Nervousness, Weakness. No quackery. Indisputable Proofs. Book sent sealed, free. ERIE MED. CO., BUFFALO, N. Y.

WEAK MEN!
Whose **VITALITY** is failing, Brain **DRAINED** and **EXHAUSTED** or Power **PREMATURELY WASTED** may find a perfect and reliable cure in the
FRENCH HOSPITAL REMEDIES
originated by **Prof. JEAN CIVIALE,** of Paris, France. Adopted by all French Physicians and being rapidly and successfully introduced here. All weakening losses and drains promptly checked. **TREATISE** giving newspaper and medical endorsements, &c., **FREE.** Consultation (office or by mail) with six eminent doctors **FREE.**
CIVIALE AGENCY, No. 174 Fulton Street, New York

DYKE'S BEARD ELIXIR Forces luxuriant Mustache, Whiskers, or hair on bald heads in 20 to 30 days. Extra Strength, Quick, Safe, Sure. No other remedy. 2 or 3 Pkgs. does the work. Will prove it or forfeit $100.00. Price per Pkg. with directions sealed and postpaid 25 cts. 3 for 50 cts. stamps or silver. Smith Mfg. Co., Palatine, Ills.

PATENTS.
MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.
BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

ROOFING
ROOFING for Buildings of every description. Durable, Light, Easily Applied, Inexpensive. **BUILDING PAPER**—Sackett's Waterproof Sheathing. Clean to Handle, Impervious to Moisture, Water, and Gases. **NEW YORK COAL TAR CHEMICAL CO. 10 Warren St., N. Y.**
BUILDING PAPER.

LOOK **$10 Orguinettes $6. Roll Music Reduced. Catalogue FREE.** MAGIC LANTERNS WANTED; also FOR SALE. **HARBACH ORGAN CO.,** Phila., Pa.

FOREIGN PATENTS.
Their Cost Reduced.

The expenses attending the procuring of patents in most foreign countries having been considerably reduced the obstacle of cost is no longer in the way of a large proportion of our inventors patenting their inventions abroad

CANADA.—The cost of a patent in Canada is even less than the cost of a United States patent, and the former includes the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, British Columbia, and Manitoba.

The number of our patentees who avail themselves of the cheap and easy method now offered for obtaining patents in Canada is very large, and is steadily increasing.

ENGLAND.—The new English law, which went into force on Jan. 1st. 1885, enables parties to secure patents in Great Britain on very moderate terms. A British patent includes England, Scotland, Wales, Ireland and the Channel Islands. Great Britain is the acknowledged financial and commercial center of the world, and her goods are sent to every quarter of the globe. A good invention is likely to realize as much for the patentee in England as his United States patent produces for him at home, and the small cost now renders it possible for almost every patentee in this country to secure a patent in Great Britain, where his rights are as well protected as in the United States.

OTHER COUNTRIES.—Patents are also obtained on very reasonable terms in France, Belgium, Germany, Austria, Russia, Italy, Spain (the latter includes Cuba and all the other Spanish Colonies), Brazil, British India, Australia, and the other British Colonies.

An experience of FORTY years has enabled the publishers of THE SCIENTIFIC AMERICAN to establish competent and trustworthy agencies in all the principal foreign countries, and it has always been their aim to have the business of their clients promptly and properly done and their interests faithfully guarded.

A pamphlet containing a synopsis of the patent laws of all countries, including the cost for each, and other information useful to persons contemplating the procuring of patents abroad, may be had on application to this office.

MUNN & CO., Editors and Proprietors of THE SCIENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly answered.

Address, **MUNN & CO.,**
Publishers and Patent Solicitors,
361 Broadway, New York.
BRANCH OFFICES: No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

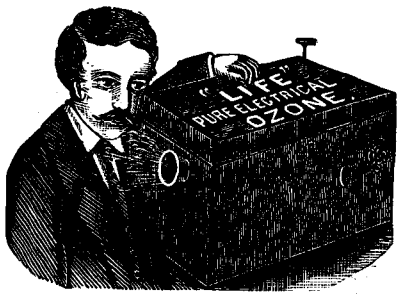
HALF A MILLION GARDENS
ARE ANNUALLY SUPPLIED WITH
SEEDS Peter Henderson's PLANTS
EVERYTHING FOR THE GARDEN

Our Seed Warehouses, the largest in New York, are fitted up with every appliance for the prompt and careful filling of orders.

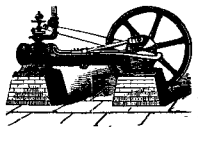
Our Green-house Establishment at Jersey City is the most extensive in America. Annual Sales, 2½ Million Plants.

Our Catalogue for 1886, of 140 pages, containing colored plates, descriptions and illustrations of the NEWEST, BEST and RAREST SEEDS and PLANTS, will be mailed on receipt of 6 cts. (in stamps) to cover postage.

PETER HENDERSON & CO. 35 & 37 Cortlandt St., NEW YORK.



—ELECTRICAL OZONE.—
The only known remedy for Catarrh. The fetid atmosphere of sick rooms, &c., made pure and sweet in six to eight minutes. Send for Illustrated Price List to T. J. YOST, 169 William Street, New York.



STEAM ENGINES.
Horizontal and Vertical.
Dredging Machinery, Flour, Powder, Slate and Flint Mill Machinery, Turbine Water Wheels.
York Mfg Co., York, Pa., U. S. A.

A BIG OFFER. To introduce them, we will **Give Away** 1,000 Self-Operating Washing Machines. If you want one send us your name, P. O. and express office at once. **The National Co., 23 Dey St. N. Y.**

SHEPARD'S NEW $60
Screw-Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scroll-saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc.
Lathes on trial. Lathes on payment.
Send for catalogue of Outfits for Amateurs or Artisans.
Address H. L. Shepard, Agent, 134 E. 2d St., Cincinnati, O.

An Engineer's Field Book.
PRICE 25 CENTS.
Address ENGINEERING NEWS PUBLISHING CO., TRIBUNE BUILDING, NEW YORK.

The New Catalogue of Valuable Papers
contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, N. Y

ICE. REFRIGERATING
and Ventilating Machines Jarmans Patent. **YORK MFG. CO., York, Pa.**

THE LARGEST Photo-Engraving ESTABLISHMENT IN THE WORLD
SIXTEEN YEARS PRACTICAL EXPERIENCE
MOSS ENGRAVING CO.
535 PEARL ST. COR. ELM. NEW YORK.
Moss' New Process Superior to Any Other Method.
ILLUSTRATIONS OF Every Description For Books, Magazines, Newspapers, Catalogues, CIRCULARS, &C. IN THE Highest Style of the Art
SEND GREEN STAMP FOR 24 PAGE CIRCULAR — SEND PHOTOGRAPH, DRAWING OR PAINT FOR ESTIMATE

© 1886 SCIENTIFIC AMERICAN, INC

SCIENTIFIC TRUTH!

REGARDING THE FUNCTIONS OF AN IMPORANT ORGAN,

Of Which the Public Knows but Little, Worthy Careful Consideration.

To the Editor of the Scientific American:

Will you permit us to make known to the public the facts we have learned during the past 8 years concerning disorders of the human Kidneys and the organs which diseased Kidneys so easily break down? You are conducting a Scientific Paper, and are unprejudiced except in favor of TRUTH. It is needless to say, no medical journal of "Code" standing would admit these facts, for very obvious reasons.

H. H. WARNER & CO.,
Proprietors of "Warner's Safe Cure."

That we may emphasize and clearly explain the relation the kidneys sustain to the general health, and how much is dependent upon them, we propose, metaphorically speaking, to take one from the human body, place in the wash bowl before us, and examine it for the public benefit.

You will imagine that we have before us a body shaped like a bean, smooth and glistening, about four inches in length, two in width, and one in thickness. It ordinarily weighs, in the adult male, about five ounces, but is somewhat lighter in the female. A small organ! you say. But understand, the body of the average size man contains about *ten quarts of blood, of which every drop passes through these filters or sewers*, as they may be called, *many times a day*, as often as through the heart, making a complete revolution in *three minutes*. From the blood they separate the waste material, working away, steadily, night and day, sleeping or waking, tireless as the heart itself, and fully of as much vital importance; removing impurities from 65 *gallons of blood each hour*, or about 49 barrels each day, or 9,125 hogsheads a year! What a wonder that the kidneys can last any length of time under this prodigious strain, treated and neglected as they are!

We slice this delicate organ open lengthwise with our knife, and will roughly describe its interior.

We find it to be of a reddish brown color, soft and easily torn; filled with hundreds of little tubes, short and thread-like, starting from the arteries, ending in a little tuft about midway from the outside opening into a cavity of considerable size, which is called the pelvis, or, roughly speaking, a sac, which is for the purpose of holding the water to further undergo purification before it passes down from here into the ureters, and so on to the outside of the body. These little tubes are the filters which do their work automatically, and *right here is where the disease of the kidney first begins.*

Doing the vast amount of work which they are obliged to, from the slightest irregularity in our habits, from cold, from high living, from stimulants, or a thousand and one other causes which occur every day, they become somewhat weakened in their nerve force.

What is the result! Congestion or stoppage of the current of blood in the small blood vessels surrounding them, which become blocked; these delicate membranes are irritated; inflammation is set up, then pus is formed, which collects in the pelvis or sac; the tubes are at first partially, and soon are totally unable to do their work. The pelvic sac goes on distending with this corruption, pressing upon the blood vessels. All this time, remember, the blood, which is entering the kidneys to be filtered, is *passing through this terrible, disgusting pus;* for it cannot take any other route!

Stop and think of it for a moment. Do you realize the importance, nay, the vital necessity, of having the kidneys in order? Can you expect when they are diseased or obstructed, no matter how little, that you can have *pure blood and escape disease?* It would be just as reasonable to expect, if a pest house were set across Broadway and countless thousands were compelled to go through its pestilential doors, an escape from contagion and disease as for one to expect the blood to escape pollution when constantly running through a diseased kidney.

Now, what is the result? Why, that the blood takes up and deposits this poison as it sweeps along into every organ, into every inch of muscle, tissue, flesh, and bone, from your head to your feet. And whenever, from hereditary influence or otherwise, some part of the body is weaker than another, a countless train of diseases is established, such as consumption, in weak lungs; dyspepsia, where there is a delicate stomach; nervousness, insanity, paralysis, or heart disease in those who have weak nerves.

The heart must soon feel the effects of the poison, as it requires pure blood to keep itin right action. It increases its stroke in number and force to compensate for the natural stimulus wanting, in its endeavor to crowd the impure blood through this obstruction, causing pain, palpitation, or an out-of-breath feeling. Unnatural as this forced labor is, the heart must soon falter, becoming weaker and weaker, until one day it *suddenly stops*, and death from apparent "heart disease" is the verdict!

But the medical profession, learned and dignified, calls these diseases by high-sounding names, treats them alone, and patients die, *for the arteries are carrying slow death to the affected part*, constantly adding fuel brought from these suppurating, pus-laden kidneys, which here in our wash bowl are very putrefaction itself, and which should have been cured first.

But this is not all the kidneys have to do; for you must remember that each adult takes about seven pounds of nourishment every twenty-four hours to supply the waste of the body which is constantly going on, a waste equal to the quantity taken. This, too, the kidneys have to separate from the blood, with all other decomposing matter.

But you say, "My kidneys are all right. I have no pain in the back." Mistaken man! People die of kidney disease of so bad a character that the organs are rotten, and yet they have *never there had a pain nor an ache!*

Why? Because the disease begins, as we have shown, in the interior of the kidney, where *there are few nerves of feeling* to convey the sensation of pain. Why this is so we may never know.

When you consider their great work, the delicacy of their structure, the ease with which they are deranged, can you wonder at the ill health of our men and women? Health and long life cannot be expected when so vital an organ is impaired. No wonder some writers say we are degenerating. Don't you see the great, the extreme, importance of keeping this machinery in working order? Could the finest engine do even a fractional part of this work, without attention from the engineer? Don't you see how dangerous this hidden disease is? It is lurking about us constantly, without giving any indication of its presence.

The most skillful physicians cannot detect it at times, *for the kidneys themselves cannot be examined* by any means which we have at our command. Even an analysis of the water, chemically and microscopically, reveals nothing definite in many cases, even when the kidneys are fairly broken down.

Then look out for them, as disease, no matter where situated, to 93 per cent, as shown by after-death examinations, has its origin in the breaking down of these secreting tubes in the interior of the kidney.

As you value health, as you desire long life free from sickness and suffering, give these organs some attention. Keep them in good condition, and thus prevent (as is easily done) all disease.

Warner's Safe Cure, as it becomes year after year better known for its wonderful cures and its power over the kidneys, has done and is doing more to increase the average duration of life than all the physicians and medicines known. Warner's Safe Cure is a true specific, mild but certain, harmless but energetic, and agreeable to the taste.

Take it when sick as a cure, and never let a month go by, if you need it, without taking a few bottles as a preventive, that the kidneys may be kept in proper order, the blood pure, that health and long life may be your blessing.

H. H. WARNER & CO.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD. CONN.

PLAYS, Dialogues, Tableaux, Speakers, etc., for School, Club, and Parlor. Best out. Catalogue free. **T. S. DENISON, Chicago, Ill.**

H.W. JOHNS' ASBESTOS
Roofing, Building Felt, Steam Packings, Boiler Coverings, Fire Proof Paints, Cements, Etc.
Samples and Descriptive Price Lists Free.
H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.
175 Randolph St., Chicago; 170 N. 4th St., Philadelphia.

SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's 127 Book of **SAWS.** We are first to introduce NATURAL GAS for heating and tempering **Saws** with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address **EMERSON, SMITH & CO. (Ltd.), Beaver Falls, Pa.**

A very strong, durable Lacing; made by a new process, and perfected, after years of experiment. It has been tried by many who use large amounts of lacing demonstrating, to their satisfaction, its superiority over other kinds. Made only by Page Belting Co., Manufacturers of Superior Leather Belting, Concord, N. H.; also Boston, New York, Chicago, St. Louis, and Cincinnati. Send for circulars.

WIRE ROPE
Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York.
Wheels and Rope for conveying power long distances. Send for circular.

DRAWING INSTRUMENTS. Illustrated catalogue sent on application to WM. T. COMSTOCK, 6 Astor Place, New York.

PROSPECTING MINERAL LANDS A SPECIALTY.
CYLINDRICAL SECTIONS OR CORES OBTAINED THE WHOLE DISTANCE BORED
ARTESIAN WELLS
BORED ROUND AND STRAIGHT ADMITTING A LARGER PUMP & CASING IN PROPORTION TO SIZE OF HOLE THAN BY ANY OTHER PROCESS. ESTIMATES GIVEN AND CONTRACTS MADE BY
THE PENNSYLVANIA DIAMOND DRILL CO.
BOX 423 POTTSVILLE PA.
MANF'RS. OF DIAMOND DRILLS FOR ALL KINDS OF —ROCK BORING.—

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 59. Price 10 cents. To be had at this office and of all newsdealers.

BOILER AND PIPE COVERINGS.
ABSOLUTELY
Fire Proof.
LIGHT and CHEAP.
EASY TO APPLY.
ASBESTOS MINERS AND MANUFACTURERS Of Braided Packing, Mill Board, SHEATHING AND SPECIALTIES.
CHALMERS-SPENCE CO., FOOT EAST 8TH STREET, N. Y.

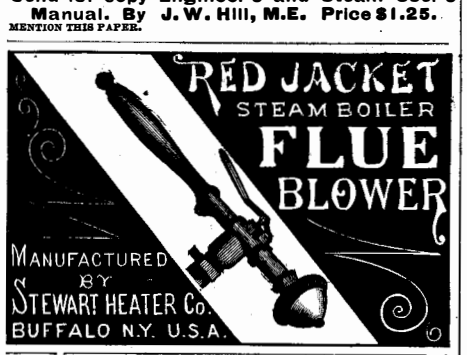
FREE MANUFACTURING SITES AT PITTSBURG, WITH NATURAL GAS.—A gentleman wishes to improve a large property. Sites unexcelled; Natural Gas; Navigable River; Railroads; cheap coal; all advantages. Address
WHITNEY & STEPHENSON, Brokers,
612 Liberty Street, Pittsburg; or A. LEGGATE, 31 Federal Street, Allegheny City, Pa.

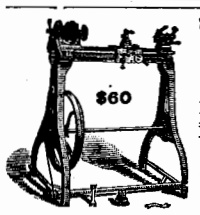
Mention this paper.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS
THOMASDEVLIN & CO. FINE TINNING, JAPANNING AND FINISHING
LEHIGH AVE & AMERICAN ST PHILA.

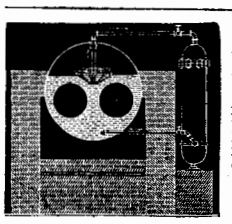
WM. A. HARRIS,
Providence, R. I. (Park St.) Six minutes' walk West from station.
Original and Only Builder of the
HARRIS-CORLISS ENGINE,
With Harris' Pat. Improvements, from 10 to 1,000 H. P
Send for copy Engineer's and Steam User's Manual. By J. W. Hill, M.E. Price $1.25.
MENTION THIS PAPER.

THE
LAMB KNITTING MACHINE
IS THE ONLY MACHINE
That knits hosiery or tubular work of all sizes.
That narrows and widens on hosiery or tubular work.
That knits a regular, right-angled hee such as is knit by hand.
That narrows off the toe.
That knits a sock or stocking complete.
That knits mittens and gloves of any size without a seam.
That forms genuine Ribbed or Seamed work.
That knits the Double, Flat, or Fancy webs.
That knits an elastic seamed-stitch Suspender with button-holes.
That knits the Afghan Stitch, Cardigan Jacket stitch, Fancy Ribbed stitch, the Raised Plaid stitch, the Nubia stitch, Shell stitch, Unique stitch, Tidy stitch, etc., etc.
It is now the Standard Machine for Manufacturing, and the
Only Family Knitter that fills the Bill.
For further particulars address
Lamb Knitting Machine Manufacturing Co.,
Box 55, CHICOPEE FALLS, MASS., U. S. A.





SEBASTIAN, MAY & CO.'S.
IMPROVED $60
Screw Cutting Lathe.
Designed for actual work; no toy. Lathes for wood or metal. Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs outfits. *Lathes on trial.* Catalogues mailed on application.
165 West 2d Street, Cincinnati, Ohio.



VAN DUZEN'S
Mechanical Boiler Cleaner.
Takes out all mud and scale forming properties from the water of Steam Boilers, keeping it clean and free from all impurities. Send for circular. Manufactured by
E. W. VAN DUZEN,
CINCINNATI, O.

BLAKE'S IMPROVED PIPE HANGER.
IT IS THE CHEAPEST AND BEST HANGER IN THE MARKET.
It saves many expensive Blacksmiths' Jobs. Can be attached to pipe when in position. Expansion always provided for. Cheap because it is simple. Pitch lines of mains easily obtained. No troublesome screws to adjust.
JENKINS BROS., SOLE AGENTS,
71 JOHN ST., NEW YORK. 13 SO. FOURTH ST., PHILA. 79 KILBY ST., BOSTON.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

PROSPECTUS
OF THE
Scientific American
FOR 1886.
The Most Popular Scientific Paper in the World.
Only $3.20 a Year, including Postage. Weekly, 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in the SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of the SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway, New York.

THE
Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology. Astronomy, Chemistry, Electricity, Light. Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information pertaining to these and allied subjects is given, the whole profusely illustrated with engravings.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are represented and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Address and remit by postal order, express money order, or check,

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, one year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for one year. This includes postage, which we pay. Remit by postal or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

PRINTING INKS.
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts. Phila., and 47 Rose St., opp. Duane St., N. Y.

© 1886 SCIENTIFIC AMERICAN, INC